



DataLyzer Spectrum Gage Management

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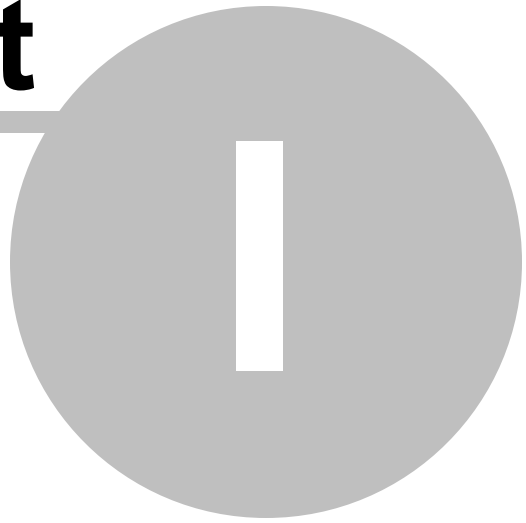
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Part



1 Introduction

How to use the Help System

While you are using the DataLyzer Spectrum Gage Management System you can press F1 on the keyboard at any time to open a help screen. Often this will give specific help for the area of the program you are currently using.

When the help screens open use the four tabs located on the left to access general areas of Help or move to individual help topics.

Contents offers a list of topics from which to choose. Click on the topic to instantly access that section of the document. You may need to click the small + beside an entry to open up a list of sub-topics.

Index allows a fast search on specific key words or phrases.

Search is a more general search for a word or phrase. It will return all occurrences of that word or phrase in a list. You can select a particular citation by double clicking an item from that list. The help system will jump to that location in the help text.

You can broaden your search to "Match similar words" by checking that box below the tabs. You can further refine a search by using the check box titled "Search previous results".

Favorites allows you to save the location of a description found in the text, so you can access it directly next time without searching or scrolling through the document.

1.1 Purpose

The Purpose of the DataLyzer Spectrum Gage Management System

The DataLyzer Spectrum Gage Management System was designed to assist supervisory personnel determine the credibility of measurements to be used in any statistical quality control effort and follows the AIAG Gage Repeatability/Reproducibility study procedures. The DataLyzer Spectrum Gage Management System provides analytical tools for measurement assurance as well as gage inventory and management.

Measurement Assurance Tools

The DataLyzer Spectrum Gage Management System provides two basic types of measurement system analysis. The first is a calibration analysis based on the accuracy of a measurement system, i.e. the extent to which bias exists in the system. The second is a set of statistical techniques (gage repeatability and reproducibility studies) that quantifies the variation a measurement system introduces into the total process variation when gages are put in the hands of actual human appraisers.

Gage Calibration (Accuracy and Extent of Bias)

Gage calibration allows you to find the difference between the observed average of measurements and the reference or “true” value. Is this bias within an acceptable range? The DataLyzer Spectrum Gage Management System further maintains a history of these accuracy analyses.

Gage Repeatability and Reproducibility Studies (Measurement System Variation)

The DataLyzer Spectrum Gage Management System determines repeatability (equipment variation) and reproducibility (appraiser variation) for both variable and attribute gaging systems. These results can then be used to evaluate the adequacy of a complete measurement system, whether total process variation can absorb significant measurement variation or whether measurement variation must be reduced and thereby reduce total process variation to an acceptable level. By performing careful R&R studies the user can draw conclusions about whether the measurement system can be used as-is, whether it must be replaced or can be improved sufficiently through a combination of operator training and equipment repair.

The program also offers an alternative graphical view relating GR&R study results to a part's specification limits in the form of a performance curve. From the curve, the confidence interval for a gage system can be determined, i.e. the measurement range within which one may be 99% confident that a measurement system will be accepting or rejecting parts properly. The difference between the confidence interval and the engineering specification limits should be applied as a reduction in tolerance due to measurement error.

Gage Inventory and Management Tools: Surveillance

The program stores hundreds of gages and provides several listing facilities to aid in inventory and scheduling of regular measurement system evaluations. Supplier information containing shipping address, product costs, service-record, etc. can be stored and referenced later at the point of gage replacement or purchase of supplies or parts.

1.2 Special Features

For GR&R analyses, gages can be studied individually or GR&R Study Definitions can be set up where a gage and DataLyzer characteristic are specified along with certain parameters of the study. If the specified gage in a GR&R Study Definition is part of a Gage Type, and the Characteristic is part of a Characteristic Group, the results can be considered as applying to all gages in the Type and all characteristics in the Group. This will reduce the number of GR&R studies required.

Individual Gage History

This is the most thorough method. It involves creating a gage entry for each gage to be tracked and for GR&R studies associating that gage with one or more product characteristics it measures. This method provides maximum traceability and the most accurate and specific information about gage performance for each job. While this method offers the highest level of traceability, it is time consuming and expensive to maintain.

GR&R using Study Definition

A GR&R Study definition is a way to specify details for repeating Repeatability & Reproducibility tests of a gage and characteristic (part) combination on a regular basis. If the gage in a Study Definition is included in a gage type, then GR&R studies performed using the Study Definition can

be considered as representative of all the gages in the gage type. If the characteristic in a Study Definition is part of a characteristic group, then GR&R studies performed using the Study Definition can be considered as representative of all the characteristics in the group. This mode is widely employed, but should only be used with the approval of management and your auditors. This method assumes that all gages of a particular type (Mitutoyo 0-1" micrometer for example) are identical, and all characteristics in a characteristic group are identical. If the premise is acceptable, you can study a specific gage and assume the study applies to all gages of that type and all characteristics in the group. It is more cost effective because it requires much less extensive record keeping than dealing with all gages and characteristics individually. However, this method is based on certain assumptions that may not always be true and may not be acceptable to specific management and/or auditing teams. In any event, this method of generalizing results by gage type only applies to gage R&R studies. Calibrations continue to be done individually, so bias and inaccuracy can be caught during calibration for individual gages.

DataLyzer Spectrum Gage Management System Consolidation with DataLyzer Spectrum SPC System

The DataLyzer Spectrum Gage Management System will operate alone or link to the DataLyzer Spectrum SPC module. By default both programs are installed in the same folder and will use a single database, therefore accessing common setup information so characteristic specifications and gage R&R results are shared between the applications.

Study due

When the DataLyzer Spectrum Gage Management System is run, the user can be warned if a gage is due for calibration or a defined GRR study is due to be repeated. This feature is enabled in the Preferences window.

1.3 Basic Steps for Use

Basic steps for calibration studies:

1. Define Gage (same definition as used for GR&R studies)
2. Define master (if master reference blocks are used)
3. Enter calibration data
4. Print report(s) - governed and enhanced by certain preferences and options

Basic steps for gage repeatability and reproducibility (GR&R) studies:

1. Optional - Define Gage (assuming it was not already defined for calibration studies above)
2. Optional – Define GR&R Study Definition and define preferences for studies.
3. Create a new GRR Study, choose a Study Definition or set parameters for the individual study.
4. Enter gage R&R data
5. Print reports.

The Setup menu allows you to define optional conveniences for use throughout the DataLyzer Spectrum Gage Management System:

- The DEFINE GAGE TYPES item can be used to create a prototype gage of a given type.

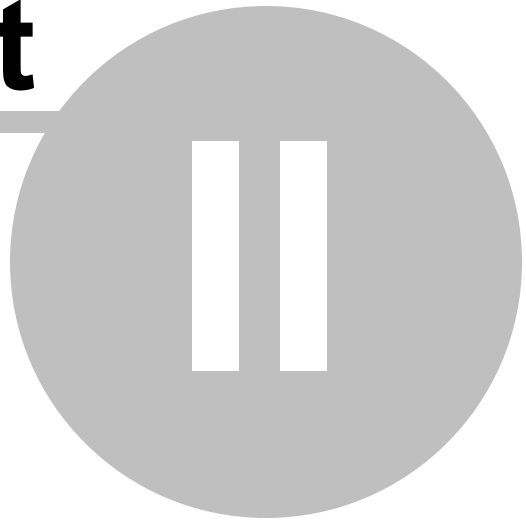
Afterwards, when you create a new gage and indicate that it is a specific gage type, fields in the "Gage Description" window can be automatically completed based on the information entered for the gage type.

- The DEFINE MASTERS item allows you to define master or "known" gage blocks to use as a measurement reference in calibration and accuracy studies.
- The DEFINE GR&R CHARACTERISTIC GROUPS item links the DataLyzer Spectrum Gage Management System with the DataLyzer Spectrum SPC program and allows you to create groups of characteristics with similar specifications for easy measuring characteristic selection.
- Using SYSTEM DEFINITIONS, you can create custom fields that will be included in the "Gage Description" window and on reports. These fields may be used to store and display additional information that is not already defined in the DataLyzer Spectrum Gage Management System. You can also use this item to modify report titles, add a logo and/or your company name to reports.
- Use PREFERENCES to set default settings for GR&R studies.
- The SUPPLIER items allow you to manage the gage supplier entries. Create, edit or delete various types of gage supply companies. Maintain information such as shipping address, costs, service records, etc. for several categories of supplier. These records allow quick reference in case the measurement instrument needs service or replacement.
- The GAGE LOCATIONS item allows you to define and catalog locations for gages.
- The GAGE STATUSES item allows you to define statuses to apply to your gages.
- The Inspectors item allows you to list the inspectors that will supervise GR&R and calibration studies.
- The GAGE INTERFACE TEMPLATE item is used to create and test gage templates for your specific gages.
- Use the COM PORT ASSIGNMENTS item to establish direct communication with electronic gages via RS-232 protocol.

Other program functions:

- Scheduling for gage calibration. This facility requires the calibration interval to be entered for each gage in its gage definition, then reports interpret and organize gages by calibration due dates.
- Scheduling for GR&R study. This facility requires the re-evaluation interval to be entered in a GR&R Study Definition.

Part

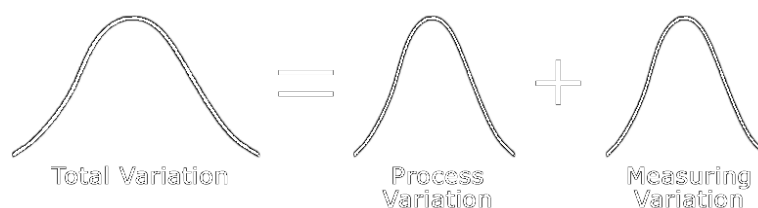


2 Explanations

2.1 Basic Concepts

Gage R&R Calibration Basic Concepts

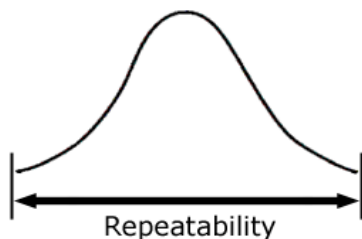
SPC analysis is largely affected by measurement system error. Measuring instruments, inspection techniques of technicians and fixturing all make up a measuring system. Any of these components can introduce variation in the measuring system. This variation in the measuring system is then reflected as part of total process variation in the SPC analysis and negatively affects key quality statistics like Cp, Ppl, Cpk, Ppk, Ppm, etc. The DataLyzer Spectrum Gage Management System helps to quantify this measurement system variation so steps can be taken to reduce it.



Every process contains inherent variation. The sources of variation can be related to any of the inputs from the mechanics of the process itself to raw material or personnel consistency. **However, it is often true that the variation in the measurement process is the most significant contributor to the overall variation of a process.**

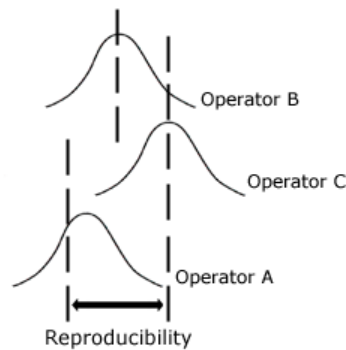
Gage Repeatability

Does a measuring system report the same result when the same master is “blindly” measured several times by the same person? Can one operator be consistent in measuring the same part/characteristic using the same gage? Repeatability is also referred to as equipment variation, because it often reflects on equipment design or condition.



Gage Reproducibility

Does a measuring system report the same results when two or three operators measure the same part/characteristic “blindly” several times? Between-operator reproducibility is the other dimension of variation in a measuring process. Gage reproducibility is also referred to as appraiser variation, because it most significantly reflects on operators’ consistency in using the measurement system. Solutions to problems of reproducibility often involve operator training.



Gage R&R studies are usually made up of two components: equipment variation and appraiser variation. These components serve to focus any remedial attention on repairing or improving the gage itself (EV-equipment variation) or training operators to use the gage correctly or more consistently (AV-appraiser variation). See report examples in the Reports descriptions for more information about appraiser and equipment variation.

Either total tolerance (USL-LSL) or total process variation (6 sigma from long range SPC data) or total study variation (6 sigma of data collected in the gage study only) can be used for calculating the proportion used in measurement error. Customer requirements typically mandate which method to use.

Guidelines for acceptance of gage repeatability and reproducibility (%R&R):

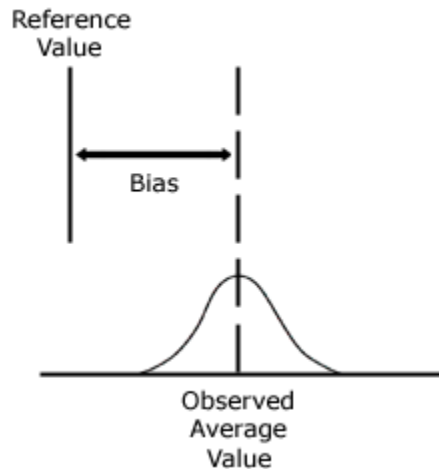
- Under 10% error: measurement is acceptable
- 10% to 30% error: measurement system may be acceptable depending on application importance cost of the gage, cost of repairs or improvement and existing process capability.
- Over 30% error: measurement system needs improvement (depending on process capability); make every effort to identify problems and correct them.

(Source AIG - MSA Manual)

Gage Calibration

Bias

This is the difference between the “true” (reference) value that the gage should be reporting and the “actual” measurement the gage is reporting.



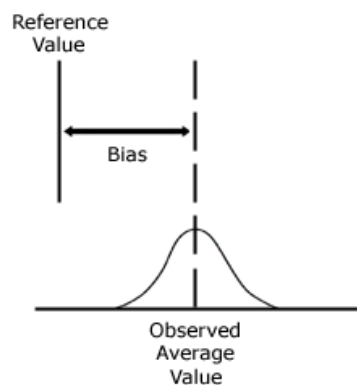
Calibration

Calibration is a one-time look at a gage or measuring system under ideal conditions (temperature controlled and clean environment). A trained and experienced technician carefully tests the measuring system. By measuring a known standard once, the amount of bias for that standard size is determined. **Bias is the difference between the observed measurement of the gage and the known standard being measured by the gage.** Bias can often be reduced through gage adjustment or repair.

DataLyzer Spectrum Gage Management System calibration studies support up to 20 reference points throughout the range of the gage, so bias can be detected at each end of the range or the gage as well as numerous points in the middle.

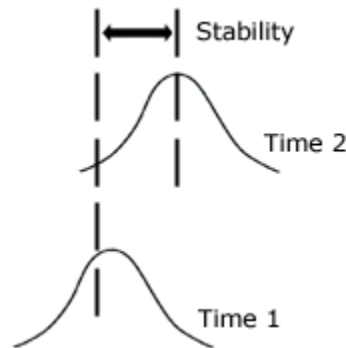
Gage Accuracy

Gage accuracy is a similar concept to calibration. The graphic below shows a gage's accuracy to be the difference between the "true average" measurement and the gage's observed average. Unlike calibration, multiple measurements are required. Again, this study is a way of determining bias.



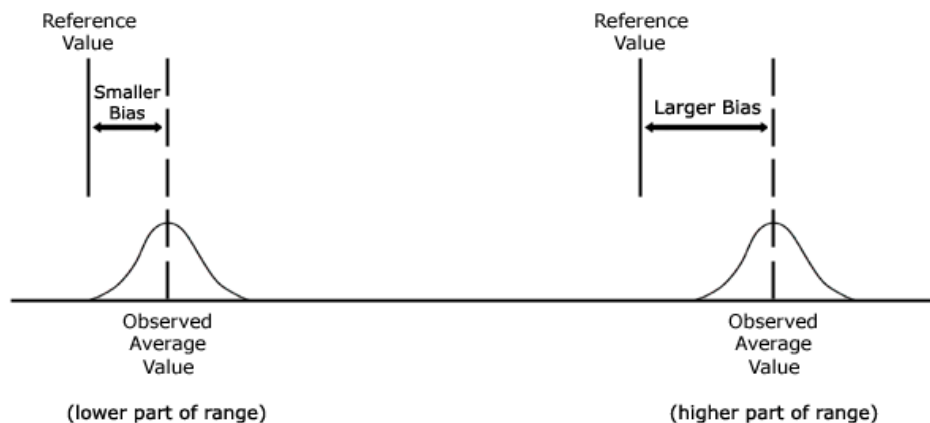
Gage Stability

Gage stability is the difference between a gage's observed measurement results as it measures the same standard over time. Multiple measurements are taken. Stability determines bias over time.



Gage Linearity

Gage linearity refers to accuracy of a gage throughout its measuring range. Often lower-end, mid-range and high-end masters are used to test for this condition. Linearity measures bias at more than one location within a measuring system's range. When a gage is used heavily in one area of its measuring range, it can become worn and less accurate in that range in comparison with other areas of its range. Multiple measurements are taken of the several standard sizes.



DataLyzer Spectrum Gage Management System calibration studies support up to 20 reference points throughout the range of the gage, so bias can be detected at each end of the range or the gage as well as numerous points in the middle.

2.2 Calibration

Calibration is the comparison of measurement and test equipment or measurement standard of unknown bias in order to detect, report, or eliminate by adjustment any variation in the bias of the instrument being studied. The process involves measuring several known standards up and down the gage's range of measurement, then verifying any differences and average differences between the gage's measurements and the true standard. If the difference is smaller than the allowed tolerance for all calibration points, the gage passes the calibration study. If the difference is larger than the allowed tolerance for any calibration point, the gage fails the calibration study and must be adjusted, sent for repair, replaced or relegated to reference use only. Some gages have more than one measurement mode, for example a calliper gage may have different jaws to measure outside diameter, inside diameter and depth. The bias of each measurement mode will have to be determined separately. Required bias is dependent on the application, along with the number of points to be measured throughout its range.

2.3 Gage R&R

The measuring process often contributes a significant amount of variation to the total variation of a manufacturing process. There are several standardized ways to study this variation. Selecting one over another depends on which type of measuring system is being used (variable or attribute gages) along with how much discrimination and precision is required vs. the amount of time available to do the study. GR&R studies can be entered for a specific gage or you can study one gage and designate results to apply for all gages of a specified gage type.

After conducting a study, a high repeatability value (also known as equipment variation or EV) can point to the need for gage maintenance, repair or redesign, or the addition of fixturing, etc. A high reproducibility value (also known as appraiser variation or AV) points to the need to increase measurement consistency between operators, possibly better measuring procedures, or additional appraiser training to develop uniform measuring techniques between operators.

Repeatability and reproducibility values are compared to "total variation" (TV) to determine a percent R&R i.e. the percent of total variation being consumed by gage error. Total variation can be defined three ways:

1. Total "tolerance" (USL-LSL)
2. Total "study" variation"
3. Total "process" variation which uses a larger sample from the manufacturing data usually collected in an associated SPC system.

Sometimes customers set which TV criteria to use but most often the practitioner is left to decide. To compare variation values calculated during the study to total tolerance, the sigma values (standard deviation or estimated standard deviation) have traditionally been multiplied by 5.15. This represent 99% of the expected full spread assuming a normal distribution curve. More recently a multiplication factor of 6 has been used, this represents 99.7% of the full spread. DataLyzer Spectrum Gage Management System can use either, choose the multiplication factor in the Preferences screen.

Guidelines for acceptance of gage repeatability and reproducibility (%R&R):

- Under 10% error: measurement is acceptable
- 10% to 30% error: measurement system may be acceptable depending on application importance, cost of the gage, cost of repairs or improvement and existing process capability.
- Over 30% error: measurement system needs improvement (depending on process capability); make every effort to identify problems and correct them.

(Source AIG - MSA Manual)

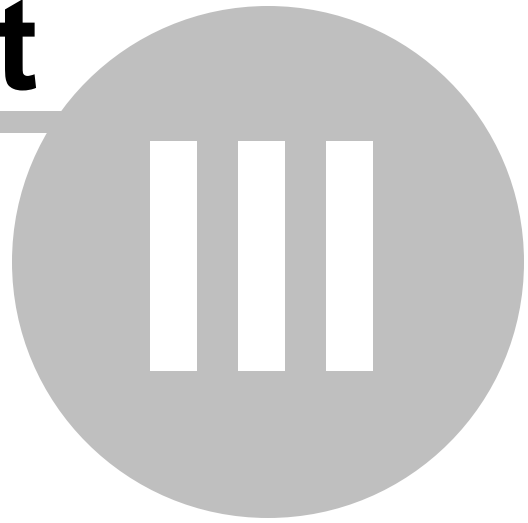
2.4 Bias studies

Gage bias studies determine the difference between a measured value and a known value. To determine bias in a gage, there must be "known" values to compare with readings taken by the gage. When the study is conducted, one operator measures one "known" standard or part ten times, and the measured values are compared to the "known" value. The bias is defined as the difference between the master value and the observed average. The percent bias is defined as $100 \times \text{bias} \div \text{process variation}$.

Bias studies do not draw conclusions regarding pass/fail like calibration studies. Because bias studies use an average of observed measurements rather than the one observed measurement at each calibration point, they may be considered more thorough than calibration studies. Bias studies also consider only one master (one calibration point), while calibration studies often use multiple masters at multiple calibration points. So, if a calibration fails at one calibration point, the bias at that point it can be studied more thoroughly using a bias study. Bias studies can only be done on variable type gages.

The bias value from the most recent bias study is used in calculations for the Performance Curve of the gage.

Part

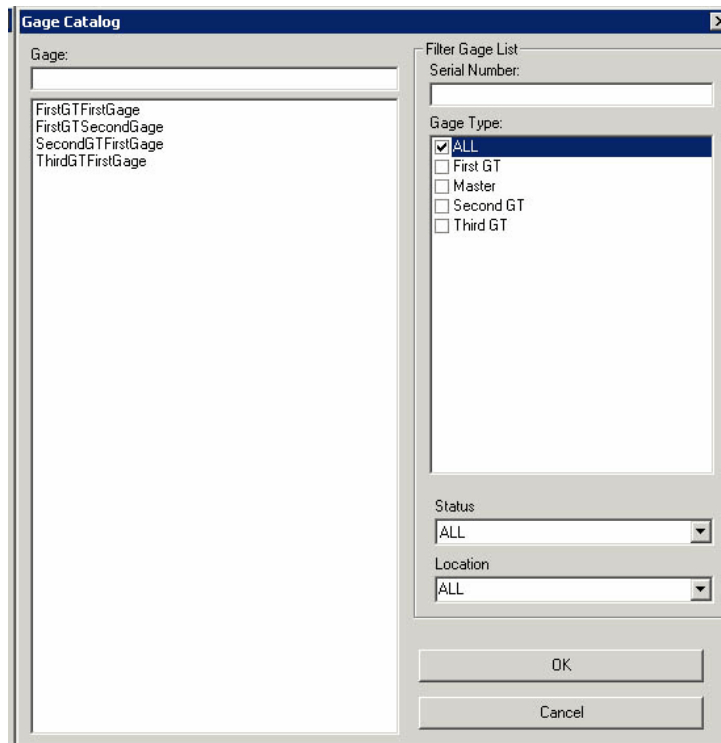


3 General Windows

The Gage Catalog and Study History windows are used in many places in the DataLyzer Spectrum Gage Management System.

3.1 Gage Catalog

When you create a new gage, need to select a gage, or delete one, the Gage Catalog window appears.



Gage Field

Enter the name of the gage in the “Gage” field or select a gage from the list below. If you are creating a new gage use a name that has not been used before. You cannot create a new gage with the name of an existing gage.

Filter Gage List frame

The frame on the right is for filtering the list of gages on the left. When creating a new gage this list is for information only.

Gage Type

Selecting a gage type in this catalog window will cause the window to refresh, showing only gages of the specified type to appear. Marking the “ALL” check box causes the screen to refresh to display all existing gages. Gage types are defined under SETUP in the main program window.

Status

If you select a status from the dropdown list (mouse click on the small arrow to reveal the list) only gages with this status will show. Statuses are defined under SETUP in the main program window. A gage is assigned a status in the Gage Description window under the FILE menu. To remove the filter and show gages with all statuses, select ALL at the top of the list.

Location

This filters the gage list in a similar way to Status.

OK Button

Pressing the OK button selects the gage currently in the Gage field.

Cancel Button

The CANCEL button exits to the DataLyzer Spectrum Gage Management main program window without saving any changes.

3.2 Calibration History

Select Enter/Edit - Calibration from the Data menu to show the Calibration History window. This window is also available from the Reports menu.

#	Number	Study Date	Performed By	Calibration Due	Status
1	000001	07/04/2010 14:06	First Inspectorzz	07/05/2010	PASS

As studies are completed, results are stored in the system. Summaries are displayed in spreadsheet form sorted by date/time with the most recent on top. Each row across in the study history window represents an individual study. Each column represents key information relating to the study.

Number Column

This is a unique serial number automatically given to each study.

Study Date Column

The "Study Date" column shows the date and time the study was performed.

Performed By

The "Performed By" column shows the name or initials of the person who performed the study. This information is taken directly from the study window as it entered the study.

Calibration Due

This is the date when calibration must be performed again. The period between calibrations is set in the Gage Description window.

Status

The "Status" field shows if the study is **Pass**, **Fail** or **Not Set**.

New Study Button and File Menu - New Study (not available from the Reports Menu)

The NEW STUDY button or menu item creates a new study. An empty form is displayed ready for data entry. See the "Calibration Study Window" description for more information regarding data entry into this form.

Edit/Review Study Button and File Menu - Edit/Review Study (not available from the Reports Menu)

The EDIT/REVIEW button or menu item opens an existing study for editing or review. Select a study by clicking in its study date field. Its row will highlight to show it is selected. Only the latest calibration study of the selected gage is available for editing, other studies are read only. Press the EDIT/REVIEW button to open the selected study. See the "Calibration Study Window" description for more information regarding the study window.

Exit Button and File Menu - Exit

The EXIT button closes the study history window and returns to the main DataLyzer Gages window.

File Menu - Delete

The DELETE item will delete the selected study. Select a study by clicking in its study number field. Its row will highlight to show it is selected. Select DELETE from the FILE menu to delete the selected study. A window will appear to confirm that you want to delete the selected study.

File Menu – Print Certificate

Select this menu item to print a calibration certificate for the currently selected calibration study. Select a study by clicking in its study number field.

File Menu – Print Label

This opens a window for printing calibration labels on A4 or similar sheets of peel-off labels. Select a study by clicking in its study number field.

File Menu – Print History

This prints the list of calibration studies.

3.3 GR&R History

The window will be empty if no studies have been performed. The NEW STUDY button will allow you to create a new GR&R study.

The screenshot shows the 'GR&R History' window. At the top, there is a menu bar with 'File' and 'Show'. Below it, a 'Study Definition' dropdown menu is set to 'All'. To the right are buttons for 'Gage' and 'All'. The main area is a table with the following columns: Study Date, Study Definition, Part, Characteristic, EV, AV, RR, and Method. The table contains 15 rows of data. The first row is highlighted. The last row has a red background. At the bottom of the window are three buttons: 'New Study', 'Edit', and 'Exit'.

Study Date	Study Definition	Part	Characteristic	EV	AV	RR	Method
11/07/2010 12:38							Long
03/07/2010 20:13	100 daysb	Part1	VarChar1			0.0%	Short
02/07/2010 20:09	100 days	Part1	VarChar1				Long
01/07/2010 20:09	100 days	Part1	VarChar1				Long
07/07/2010 14:30							Long
07/07/2010 14:28		Part1	VarChar1				Long
07/07/2010 14:27		Part1	VarChar1				Long
07/07/2010 13:42		Part1	VarChar1				Long
07/07/2010 10:34		Part1	VarChar1	17.6%	20.0%	26.7%	Long
06/07/2010 17:26		Part1	VarChar1	17.7%	20.1%		Long
06/07/2010 17:19				19.7%	21.0%		ANOVA
06/07/2010 17:14				19.7%	21.0%		ANOVA
06/07/2010 17:05				17.7%	20.1%		ANOVA
06/07/2010 16:52				17.7%	20.1%		Long

As studies are completed, results are stored in the system. Summaries are displayed in spreadsheet form sorted by date/time with the most recent on top. Each row represents an individual study. Each column represents a key statistic or label relating to the study. Each study type has different statistics in the study history window. To delete a study, click anywhere on the study's row and press the delete key. It is important to note that certain studies do not provide all these statistics and so certain fields will be blank; for example, long attribute studies only provide equipment variation (EV) since they involve just one appraiser. Short attribute studies offer no AV, EV, or RR results, since only a pass or fail conclusion is drawn. Short variable studies require only one trial from 2 operators so only AV can be measured.

Show Menu

Over time the number of studies stored can get very long, which can slow down the loading of the list. As you are likely to be most interested in the most recent studies, the Show Menu allows you to improve performance by limiting the number of studies listed.

Study Definition (drop down list)

The drop down list under the menu bar allows you to filter the table to show only studies which used particular Study Definition. Click the small down arrow at the right hand end of the box to show the list of Study Definitions. Select "All" to show all Study Definitions.

Gage Button

Click the button to select a Gage from the Gage Catalog. The table will then only show studies which used the selected gage. Click the All button to remove the filter.

Study Date

The "Study Date" field displays the date and time the study was performed.

Study Definition

If the study was based on a Study Definition, the name will be shown in this column.

Part

The "Part" field displays the name of the part being measured in the study.

Characteristic

The "Characteristic" field displays the name of the characteristic being measured in the study.

EV (Equipment Variation)

Equipment variation (EV) = gage repeatability. The values in the "EV" (Equipment Variation) field represent the variation in the measurement process associated with the gaging equipment itself, presented as a percentage of Total Variation (TV).

AV (Appraiser Variation)

Appraiser variation (AV) = gage reproducibility. The values in the "AV" (Appraiser Variation) field represent the variation in the measurements between personnel using the gaging system, presented as a percentage of Total Variation (TV).

RR (Repeatability and Reproducibility)

Repeatability and Reproducibility is the combined variation due to EV and AV, presented as a percentage of Total Variation (TV). The RR field will turn green for pass, or red for fail after the study is completed. Set the "pass %" level in the Preferences window.

The total variation (TV) method used in the above calculation is set in the GR&R Study.

Method

The "method" column displays the method used for the study e.g. long variable, short attribute, etc.

New Study Button and File Menu - New Study

The NEW STUDY button or menu item creates a new study. You are first prompted to select a Study Definition. If you want to start a GR&R study that is not based on a Study Definition, select "[none]". An empty form then is displayed ready for data entry. See "Gage R&R Study" section for more information regarding data entry into this form.

Edit Button and File Menu

The EDIT button or menu item opens an existing study for editing or review. Select a study by clicking in its study date field. Its row will highlight to show it is selected. Press the "Edit" button to open the selected study. You can also select a study by double clicking it.

Exit Button and File Menu - Exit

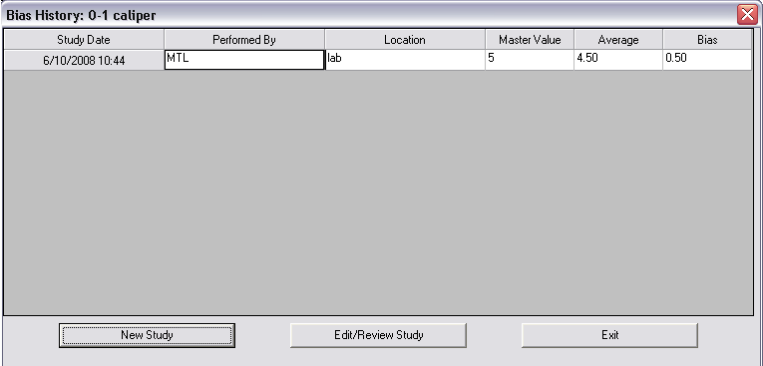
The EXIT button closes the study history window and returns to the main program window.

File Menu - Delete

The DELETE item will delete the selected study. Select a study by clicking in its study date field. Its row will highlight to show it is selected. Select DELETE from the FILE menu to delete the selected study. A window will appear to confirm that you want to delete the selected study.

3.4 Bias History

The "Bias History" window looks like this:



Study Date	Performed By	Location	Master Value	Average	Bias
6/10/2008 10:44	MTL	lab	5	4.50	0.50

New Study Edit/Review Study Exit

As studies are completed, results are stored in the system. Bias study summaries will be displayed in spreadsheet form sorted by date/time with the most recent on top. Each row represents an individual study. Each column represents a key statistic or label relating to the study.

Study Date Column

The "Study Date" column shows the date and time the study was performed.

Performed By

The "Performed By" column shows the name or initials of the person who performed the study. This information is taken directly from the study window as it was entered to define the study.

Location

The "Location" column shows the location where the study was performed.

Master Value

The "Master Value" column shows master value of the standard being measured.

Average

The "Average" column shows the average value of the readings taken by the gage.

Bias

The "Bias" column shows the difference between the master value and the observed average.

New Study Button

The NEW STUDY button creates a new study. An empty form is displayed ready for data entry. See the "Bias Data Window" description for more information regarding data entry into this form.

Edit/Review Study Button

The EDIT/REVIEW button opens an existing study for editing or review. Select a study by clicking in its study date field. Its row will highlight to show it is selected. Press the EDIT/REVIEW button to open the selected study. See the "Bias Data Window" description for more information regarding the study window.

Exit Button

The EXIT button closes the study history window and returns to the main DataLyzer Gages window.

Part

IV

4 Gage Details - (File Menu)

Select items from the File menu to create gages, delete gages and edit gage details. You can also create, delete and edit GR&R Study Definitions from the File Menu.

4.1 Gage Description

If you select New Gage or Open Gage from the File menu the Gage Description window opens.

The screenshot shows the 'Gage Description' window with a menu bar (File, GR&R, Calibration) and a close button (X). The form contains the following fields and controls:

- Name/ID #: FirstGTFirstGage
- Gage Type: First GT (dropdown arrow)
- Manufacturer: (text field)
- Model #: Model
- Description: Description
- Category: ☒ Variable ☐ Attribute
- GRR Re-evaluation Interval: 90 Days
- Precision: (text field)
- Calibration Re-evaluation Interval: 30 Days
- Range: (text field)
- Resolution: (text field)
- Units: (text field)
- Serial Number: Serial No
- Company #: Company No
- Date of Purchase: (text field)
- PO #: (text field)
- Cost: (text field)
- Status: First Status
- Location: First Location
- #1 Gage Supplier: (text field)
- #2 Gage Supplier: (text field)
- Documentation #: (text field)
- Battery Type: (text field)
- #1 Supplies Company: (text field)
- #2 Supplies Company: (text field)
- Other Supplies: (text field)
- Notes: (text area)

Name/ID

The "Name/ID #" is the name given to the individual gage. It will be used to identify the gage in the gage catalog. The Name/ID# is initially defined in the gage catalog window when creating a new gage, however, it can be changed here.

Gage Type

You can assign a Gage to a Gage Type by clicking on the arrow at the right hand end of the field

and selecting from the dropdown list. When you select a gage type you will be offered the option to automatically fill many of the fields from the corresponding entries for the Gage Type. Gage Types are created in the SETUP menu of the main program window.

Serial Number

The "Serial Number" is the unique serial number assigned to the gage by the manufacturer.

Company #

This field can be used to store a serial number assigned to the gage by the company if this is different from the entry in the Name/ID# field.

Date of Purchase

Enter the date the gage was invoiced by the supplier in the "Date of Purchase" field so in the future you will know how old the gage is.

PO#

Enter the purchase order number used by your organization to purchase the gage in the "PO#" field.

Cost

Enter the price paid for this gage in the "cost" field.

Status

Set the current status of the master by clicking on the Status button and selecting from the list. No manual entry is allowed, you must pick from the list.

Location

Set the current status of the master by clicking on the Location button and selecting from the list. You can also type in a location that is not in the list.

Variable / Attribute

The "Variable" or "Attribute" items are used to further identify the gage type and the type of studies to be performed. Variable gages enter numeric measurements; attribute gages give measurements such as defect information or go/no-go information.

Calibration Re-evaluation Interval

Enter the interval between gage calibration analyses. Refer to your quality manual for this interval. Enter 0 (zero) for gages that are only used for reference and do not need to be regularly studied. The re-evaluation period can be set in Days or Months, this is chosen using the in Preferences item in the SETUP menu of the main program window.

Precision of the Gage

Enter the smallest interval the gage can measure in the "Precision" field.

Range of the Gage

Enter the range between the smallest and the largest sizes measurable by the gage in the "Range" field.

Manufacturer Button

No manual entry is allowed in the “Manufacturer” field. For entry in this field, use the MANUFACTURER button to open the “Suppliers” list to select or create a manufacturer. To select a predefined supplier’s name from the list, double click on it or highlight it in the list and press the SELECT button. To create a new supplier, enter a supplier name in the “Company” field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The “Gage Suppliers” setup window will then appear (see the description of this window). Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

#1 and #2 Gage Supplier Button

No manual entry is allowed in the “#1 Gage Supplier” or “#2 Gage Supplier” fields. For entry in these fields, use the #1 GAGE SUPPLIER and the #2 GAGE SUPPLIER buttons to open the “Suppliers” list to select or create a supplier. Note that the “gage sales” option button is selected in this window, allowing only predefined suppliers of that type to appear in the list. To select a predefined supplier’s name from the list, double click on it or highlight it in the list and press the SELECT button. To create a new supplier, type a supplier name in the “Company” field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The “Gage Suppliers” setup window will then appear (see the description of this window). Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Documentation #

The “Documentation #” field can be used to include the last invoice number used to purchase the gage or other documentation such as a reference to the instrument user’s manuals and their location.

Battery Type

The “Battery Type” field allows you to indicate what type of battery the gage requires (if any).

#1 and #2 Supplies Company Buttons

No manual entry is allowed in the “#1 Supplies Company” or “#2 Supplies Company” fields. For entry in these fields, use the #1 SUPPLIES COMPANY and the #2 SUPPLIES COMPANY buttons to open the “Suppliers” list to select or create a supplier. To select a predefined supplier’s name from the list, double click on it or highlight it in the list and press the SELECT button. Press CANCEL to exit without selecting a supplier. To create a new supplier, type a supplier name in the “Company” field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The “Gage Suppliers” setup window will then appear (see the description of this window). Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Other Supplies

The “Other Supplies” field is an optional field used for noting external gage supplies like batteries, cables, chemicals, attachments, printer paper or other miscellaneous items consumed while using the gage.

Notes

Use the "Notes" field to enter miscellaneous user notes about the gage. A maximum of 3000 characters are allowed in this field. Full calibration procedures, graphical attachments and work instruction documents are available in the INSTRUCTIONS items under the GR&R and CALIBRATION menus.

User Defined Fields 1-12

The "user" fields only appear if they have been previously setup in the "headers fields" tab under SETUP, SYSTEM DEFINITIONS. These fields will appear at the bottom of the window beneath the "Notes" area not only in the in the Gage Definition window but also in the reports. They are available for entering any information you wish (up to 24 characters per field – 12 fields max. they are global for all gages). See the "header fields" description here for additional information.

File Menu - Save or [F2]

SAVE (or pressing [F2] from outside the menu) saves the changes made to the gage description form.

File Menu - Save & Exit or [Ctrl]+[S]

SAVE & EXIT (or pressing [Ctrl]+[S] from outside the menu) saves the changes made to the gage description form and exits the gage description window.

File Menu - Exit or [Ctrl]+[X]

EXIT (or pressing [Ctrl]+[X] from outside the menu) exits the gage description window. If you have made change to any of the fields in the window, you will be asked if you want to save the changes before exiting.

File Menu – Save as Another Gage

When you choose this menu option a new gage will be created with the current values in the fields. You must alter the Name/ID# field to a unique name or number before selecting this option.

GR&R Menu - Instructions

Opens the Instructions Window for setting the instructions and attachments to be used for Gage R&R studies.

GR&R Menu - History

Opens the GR&R History Window

Calibration Menu - Instructions

Opens the Instructions Window for setting the instructions and attachments to be used for Calibration studies.

Calibration Menu - History

Opens the Calibration History Window

4.2 Measuring Instructions - Set

The Measuring Instructions windows is in Set mode if it is opened from the Gage Description window or Gage Type window.

Example calibration gage : GR&R Attachments

GR&R Measuring Instructions:

GR&R Control Plan Reference:

Attachment 1 Set

Attachment 2 Set

Attachment 3 Set

Attachment 4 Set

Attachment 5 Set

☐ Specify web addresses

OK

Measuring Instructions Field

Enter instructions for how to run the GR&R or Calibration study in the "Measuring Instructions" field (3000 characters max.). This field can be left blank but it is not recommended. Different instructions and attachments are stored for Calibration and GR&R studies.

Control Plan Reference

The "Control Plan Reference" field allows you to cite the applicable page or paragraph in your control plan describing how Gage R&R studies for this gage should be conducted. It can also be left blank.

Set Buttons

By clicking any of the five SET buttons you can browse your computer and network resources to select files such as images, documents, videos, or spreadsheets that will then be attached to the selected button. Web addresses can also be attached; see "specify web address" below. These

attachments are intended to augment measuring instructions for the gage at the time when it is being studied. Up to five attachments of the types listed below can be selected (one per button). At the point when you or your staff is actually performing the studies, attachment buttons will be available in a measuring instructions window. Clicking the attachment buttons at that point will cause the system to follow the link you are establishing now and result in the instantaneous display of the “attached” file linked to it. It may be a picture file like a jpg or tif. It may be an MS Word or Excel file or it might even be a movie about how to do sampling for the study. These attachments can be a powerful addition to assist in performing a study.

Supported attachment file types include:

Document Files	Movie Files
Text Files (*.txt)	AVI Movie (*.avi;*.wmv)
Rich Text Format Files (*.rtf)	Audio File (*.wav;*.aif;*.au;*.snd;*.wma;*.aiff)
Word Document Files (*.doc)†	MPEG Movie (*.mpg;*.mp2;*.mpeg;*.m1v;*.mpe;*.mpv)
Acrobat Files (*.pdf)†	Quick Time 2 (*.qt;*.mov)
Hypertext files (*.htm;*.html)	Windows Media File (*.asf;*.wm;*.wma;*.wmv)
Image Files	Other
AutoCAD (*.dwg;*.dxf)	Excel Files (*.xls;*.xlw)†
CADKey (*.prt)	PowerPoint Files (*.ppt)†
BMP Images (*.bmp)	Web addresses
GIF Images (*.gif)	
JPEG Images (*.jpg;*.jpeg)	
PCX Images (*.pcx)	
PNG Images (*.png)	
TIFF Images (*.tif;*.tiff)	
WMF Images (*.wmf)	

† Note: The DataLyzer Spectrum Gage Management software provides an internal utility for viewing .doc and .xls files, however: Microsoft® Excel Viewer must be installed locally (on drive C:) for embedded graphic and multiple worksheet support, otherwise only the cell contents of the first worksheet are visible; Microsoft® Word Viewer must be installed locally (on drive C:) for graphics and framing objects support; Microsoft® PowerPoint Viewer must be installed locally (on drive C:) to view PowerPoint files; Adobe Reader must be installed locally (on drive C:) to view Acrobat (.pdf) files.

To detach a file, press the desired SET button. When the “Open” browser window appears, press the CANCEL button. The program will ask if you would like to remove the file; press YES.

Specify Web Addresses

To enter or edit a web address as an attachment, mark the “specify web addresses” checkbox before pressing the SET button. A dialog box window will appear where you can enter the web address path required. To attach another file type, unmark the “specify web addresses” checkbox before pressing another SET button.

Attachment Buttons

After setting a file or website, click the Attachment to check that the link is working.

4.3 GR&R Study Definition

A GR&R Study definition is a way to specify details for Repeatability & Reproducibility tests of a gage and characteristic (part) combination that will be regularly repeated.

If you select New GR&R Study Definition or Open GR&R Study Definition the Study Definition window opens.

Name

The Study Definition name must be unique

Gage frame

If you have defined gages click the Gage button to select a gage. If you have not defined any gages you can just type in the name of the gage here. If the gage was selected by clicking the Gage button the category of the gage will be shown (variable or attribute) in the frame and the Gage Type (if the gage is included in a Gage Type).

If the gage is included in a Gage Type, then GR&R studies performed using this Study Definition can be considered as representative of all the gages in the gage type. If at least one GR&R study has

been created using the Study Definition, the Gage Type will become “locked”. This means that you can only change the specified gage to another gage in the Type.

Characteristic frame

If the program is being used in conjunction with Datalyzer Spectrum you can select a Datalyzer Part and Characteristic using the buttons in this frame. Otherwise, just type-in Part and Characteristic names. If a Datalyzer characteristic is selected the Upper and Lower specification limits will be displayed along with the category of the characteristic (variable or attribute). If the characteristic is included in a characteristic group, the group will be shown.

You can enter USL and LSL manually if the program is not being used in conjunction with Datalyzer. Tolerance (USL- LSL) is one of the Total Variation (TV) methods.

If the selected characteristic is part of a characteristic group, then GR&R studies performed using this Study Definition can be considered as representative of all the characteristics in the group. If at least one GR&R study has been created using this Study Definition, the characteristic group will become “locked”. This means that you can only change the specified characteristic to another characteristic in the group.

Re-evaluation required every .. days

If this box is checked a new GR&R study with the Study Definition will be due after a specified time. Studies coming up for re-evaluation can be seen in the Gage Lists / GRR Due report. The user can also be alerted when the program is started if the time for a re-evaluation is approaching.

Parameters Button

Clicking the Parameters button brings up the Study Parameters screen.

The screenshot shows the 'Study Parameters' dialog box. It features a title bar with a close button. The main area contains several radio buttons for selecting the study type: 'Study Variation' (selected), 'GR&R Attribute Study' (unselected), 'Long Form' (selected), and 'Short Form' (unselected). Below these are three input fields for numerical values: 'Number of Appraisers' (value 3, range 2 to 4), 'Number of Parts' (value 10, range 5 to 10), and 'Number of Trials' (value 3, range 2 to 4). At the bottom, there is a section titled 'Data Entry Method' with three radio buttons: 'Open Sheet' (selected), 'By Trial' (unselected), and 'Randomized' (unselected). The dialog concludes with 'OK' and 'Cancel' buttons.

The category of the study (variable or attribute), and long or short form dictate what entries are acceptable in the “Number of Appraisers”, “Number of Trials”, and “Number of Parts” fields. The following list contains recommended values for the fields for each type of GR&R study. Some values are set and locked by the software, as indicated to force the study to conform to generally accepted rules.

	Variable Gage Study			Attribute Gage Study		
	Appraisers	Trials	Parts	Appraisers	Trials	Parts
Long	2-4	2-4	5-10	1 (locked)	20 (locked)	8-10
Short	2 (locked)	1 (locked)	5 (locked)	2 (locked)	2 (locked)	20 (locked)

Number of Appraisers

Enter the number of operators to be included in the study in the “Number of Appraisers” field. In certain study types, the number of appraisers is set and locked by the software. See the table above for the number of appraisers recommended or allowed for the different study types. (Study validity depends on these appraisers being the same individuals who ordinarily measure production parts.)

Number of Parts

Enter the number of sample parts to be measured in the “Number of Parts” field. In certain study types, the number of parts is set and locked by the software. See the table above for the number of parts recommended or allowed for the different study types.

Number of Trials

Enter the number of trials to be included in the study in the “Number of Trials” field. “Trial” refers to the number of times a set of samples are measured. In certain study types, the number of trials is set and locked by the software. See the table above for the number of trials recommended or allowed for the different study types. (Study validity depends on these trials being conducted blindly so that appraisers do not know results from previous associated trials.)

Data Entry Method

The “Open Sheet” method can be used with all studies. Appraisers user can enter study data in any order.

The “By Trial” method can be used with long or short variable and short attribute studies. Using this method, all entries are made in one appraiser trial at a time (column-by-column). Data entry is organized by trial and must be entered in the order prompted by the system.

The “Randomized” method can be used with long or short variable and short attribute studies. For valid results, this method must be used for long variable studies using the ANOVA calculation method.

Part



V

5 Gage Studies - (Data Menu)

Selecting items in the Data menu allows you to create, delete or edit Calibration, GR&R and Bias studies

5.1 GR&R Analysis Tools

Note: Most of the “Analyze” graphical tools relate to Long variable and ANOVA studies with the exception of the Performance Curve which also applies to Long Attribute Studies. When you select the ANALYSIS TOOLS item (or press [F5] without opening the menu), a window will appear containing a set of tabs. These tabs contain different statistical or graphical analyses of the Gage R&R Study. You can preview information in these tabs and click the “Print” check box to include them in a report. Some of these analysis tools are available in other forms in the reports menu but this is the only place where you can select your own report components.

For ANOVA variable studies the following tabbed sections are included: Statistics, Data, and Average Plot.

For Average and Range variable studies the following tabbed sections are included: Statistics, Data, Performance Curve, Average Charts (with run chart, averages chart, X-Y Plot options), Individuals Charts (with normalized, whisker, scatter plot options), Range & Error Charts (with range chart, error chart options).

Each tab in the preview window is described below.

On each of the tabbed sections, you will find these common items:

Exit Button

The EXIT button closes the window and returns to the GR&R study window.

Print Checkbox

Mark the “print” checkbox to include the graph or information on the current tab in a report generated by pressing the PRINT button.

Print Button

Use the PRINT button to print a report. If you have marked the “print” checkbox on any of the tabbed sections, any graphs and information on those marked tabs will be included on the report. If you press the PRINT button without any checkboxes marked, the GR&R Report Definition window will appear which allows you to quickly select which report components you would like to include. This unique area offers print options not available from the REPORTS menu in the main program window.

Statistics Tab

The “statistics” tab contains a detailed listing of key statistics in the GR&R study. This tab applies to both Average / Range and ANOVA studies.

GR&R ANOVA Method

Statistics Data Average Plot

ANOVA Supporting Calculations

Source	DF	SS	MS	F
Appraiser	2	3.1673	1.5836	
Parts	9	88.3619	9.8180	
Appr x Part	18	0.3590	0.0199	0.43
Error	60	2.7589	0.0460	
Total	89	94.6471		

Total Variation

☒ Study
 ☐ Tolerance
 ☐ Process - when saved
 ☐ Process - current
 6.5364 6 Std. Dev.

Results

	Lower 90% CL	6 Std. Dev.	Upper 90% CL	% of Variation	% Contribution
Repeatability - Equipment Variation (EV)	0	1.2866	0	19.7%	3.9%
Reproducibility - Appraiser Variation (AV)	5.4696	1.3698	19.8309	21.0%	4.4%
Part x Appraiser Interaction	-0.0116	0.0000	-0.0034	0.0%	0.0%
Repeatability & Reproducibility (R&R)	1.1997	1.8793	5.3064	28.8%	8.3%
Part Variation (PV)	3.4209	6.2604	8.4331	95.8%	91.7%

☐ Print

Print Exit

You can see the effects of different Total Variation methods by clicking on the options in the Total Variation frame. The “Process” options are only available if a Datalyzer Characteristic was selected for the study. With the “Process – when saved” option a calculation of the Standard Deviation of the last one hundred data points was made when the GRR study was saved. “Process – current” will recalculate process variation with the most recent one hundred data points. One hundred data points is irrespective of the subgroup size, for example 10 subgroups with subgroup size is 10, or 100 subgroups with subgroup size 1 (X & Mr charts).

Data Tab

The “data” tab produces a data table with parts measured as rows and each appraiser/trial as a column. This tab applies to both long variable and ANOVA studies.

GR&R Average & Range Method									
Average Charts			Individuals Charts			Range & Error Charts			
Statistics			Data			Performance Curve			
Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #1 Trial #3	Appr #2 Trial #1	Appr #2 Trial #2	Appr #2 Trial #3	Appr #3 Trial #1	Appr #3 Trial #2	Appr #3 Trial #3
1	.56	.62	.64	.55	.52	.6	.64	1	.62
2	.57	.65	.61	1	1	1	.65	.6	.64
3	.83	.63	.65	.68	.57	.63	.62	1	.54
4	.61	.54	1	.58	.56	.65	.68	.57	.57
5	.58	.59	.51	.54	.6	.58	1	.53	.56
6	.62	1	.52	.64	.61	.59	.58	.54	.58
7	.67	.61	.57	.53	.61	.6	.52	1	.57
8	.7	.62	.72	.81	.57	.58	.54	.57	.61
9	.56	.63	.6	1	1	1	.64	.58	.62
10	.9	.53	.54	.54	.58	.61	.61	.61	.68

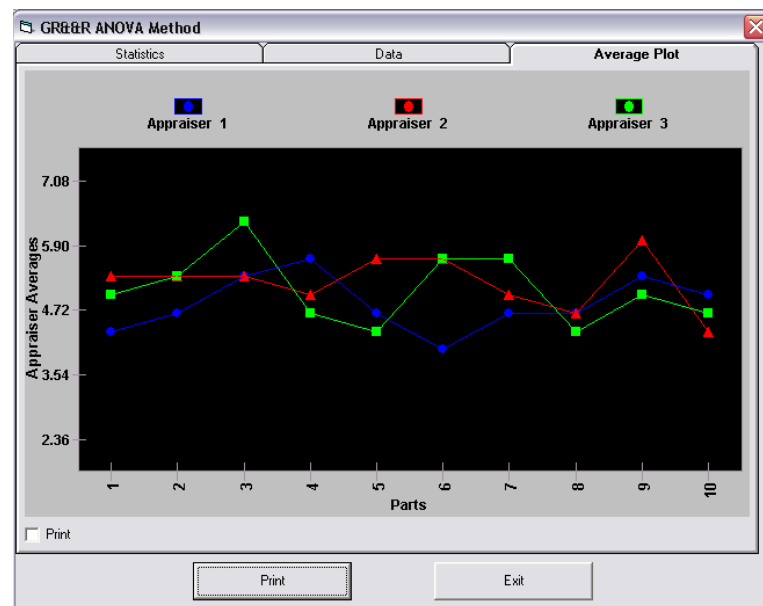
☐ Print

Print Exit

Average Plot Tab

The “average plot” tab applies only to ANOVA studies.

The purpose of the “averages plot” graph is to show potential differences in reproducibility between operator averages for the same part. Option buttons designate which one of three graphical analyses will be displayed. They include: runs chart, averages chart, and X-Y plot.



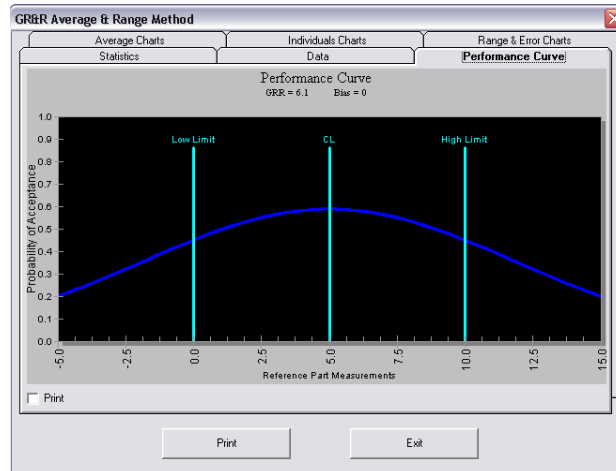
Performance Curve Tab

The purpose of a gage performance curve is to determine the probability of a measurement system

either accepting or rejecting parts improperly using data from Long Variable and Attribute gage studies. This tab applies to long and short variable studies and long attribute studies.

Once the amount of gage error has been determined via a gage study, it is possible to calculate the probability of accepting a part of some reference value when using the gage. To accomplish this, the assumption is made that repeatability and reproducibility are normally distributed with some variance, s^2 .

The gage performance curve provides a graphical method of communicating how well the measurement system is discriminating good parts from bad parts as the measurements approach the decision points at the upper and lower specs.



The graph contains x- and y- axes. The x-axis along the bottom contains values as reflected by the measurement system. The y-axis relates to the percent confidence. Specification limits are shown as vertical lines intersecting the x-axis. Normal curve tails intersect these specs and represent confidence indicators. At the intersection of either spec you can read the corresponding left or right scale to see the confidence one has in the measuring system's result at that size. For instance, in the case above the gage being used needs to be replaced because at the lower specification limit (0.00) we can only be about 45% confident about making the right decision to accept or reject product.(worse than simply flipping a coin).

Discrimination required from the gaging system is a function of cost, of the gage itself, of the products being measured and improperly scrapped, and of the personnel time required to do the inspection.

The bias value from the most recent bias study is used in calculations for the performance curve.

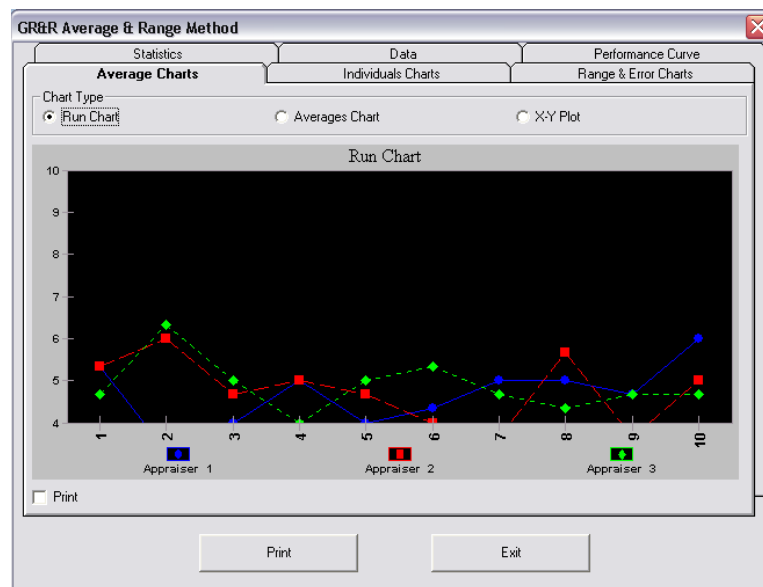
Average Charts Tab

The purpose of the "averages charts" analyses is to show potential differences in reproducibility between operator averages for the same part. Option buttons designate which one of three graphical analyses will be displayed/printed. They include: runs chart, averages chart, and X-Y plot.

Run Chart

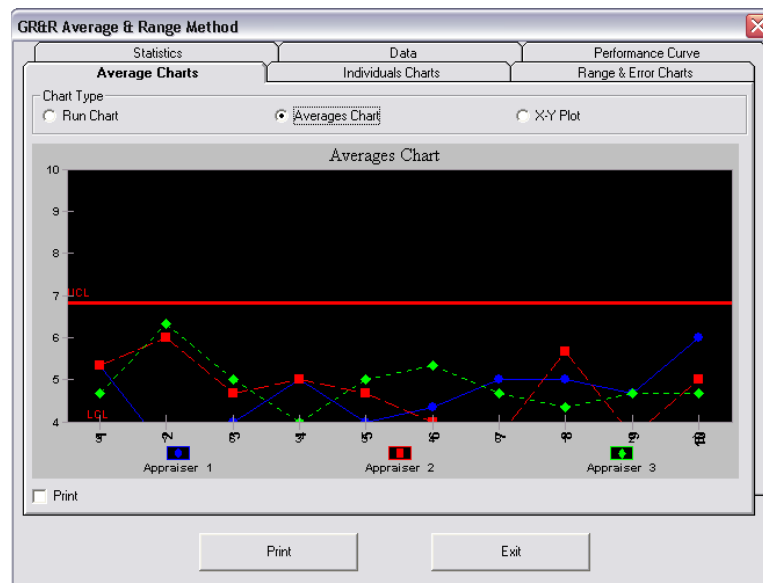
The "run chart" option displays data points that represent the average of each appraiser's trials for

each part. Each appraiser's data points are displayed in a different color and shape. Lines of the associated color connect each appraiser's trial-avg points. In a perfect situation, all points would be in identical locations on the graph.



Averages Chart

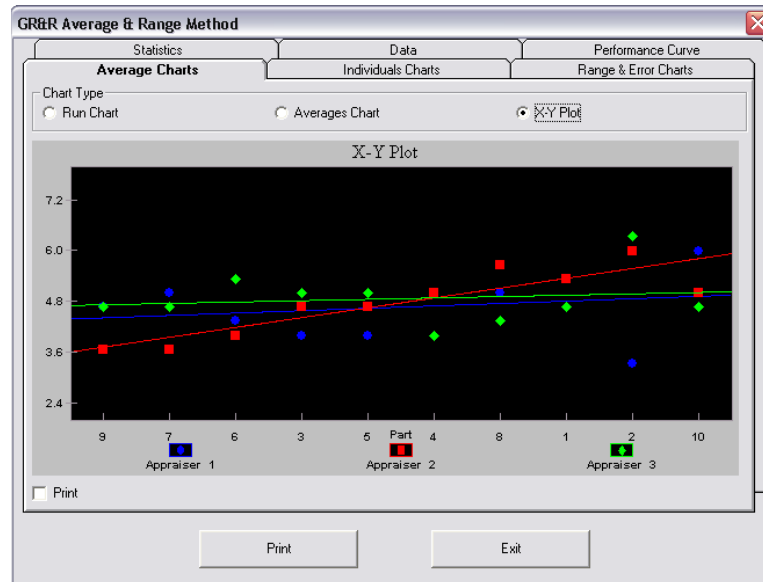
The "averages chart" option adds control limits that are calculated by using the average appraiser trial points for each part as subgroups.



X-Y Plot

The "X-Y Plot" option ranks the parts in the study smallest to largest using a calculated grand

average for each part. This ranking becomes the x-axis and represents the order the part trial averages are plotted left to right. Measured average is the y-axis. A linear regression is plotted on each operator's points. Dramatic differences between operator performances can be addressed by training or other remedial measures.

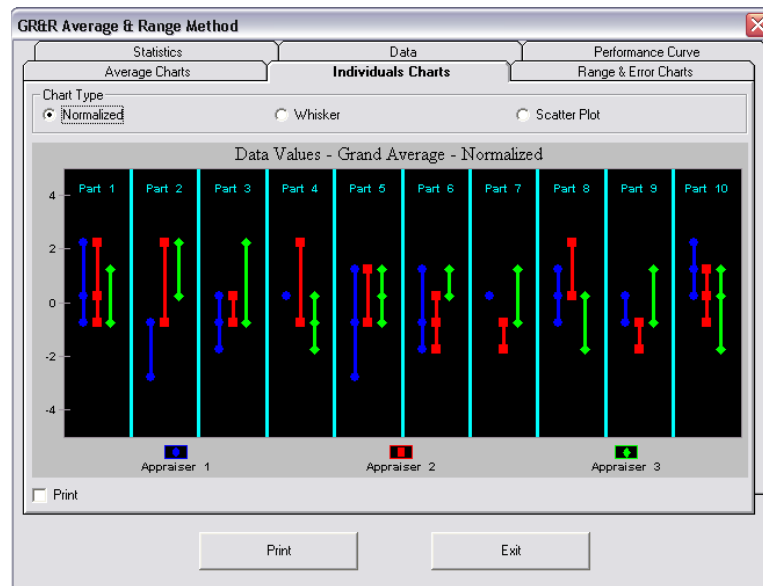


Individuals Charts Tab

On the "individuals charts" tab, part size is on the Y-axis and parts measured follow the X-axis. Option buttons include: normalized, whisker, and scatter plot. This tab only applies to long variable studies.

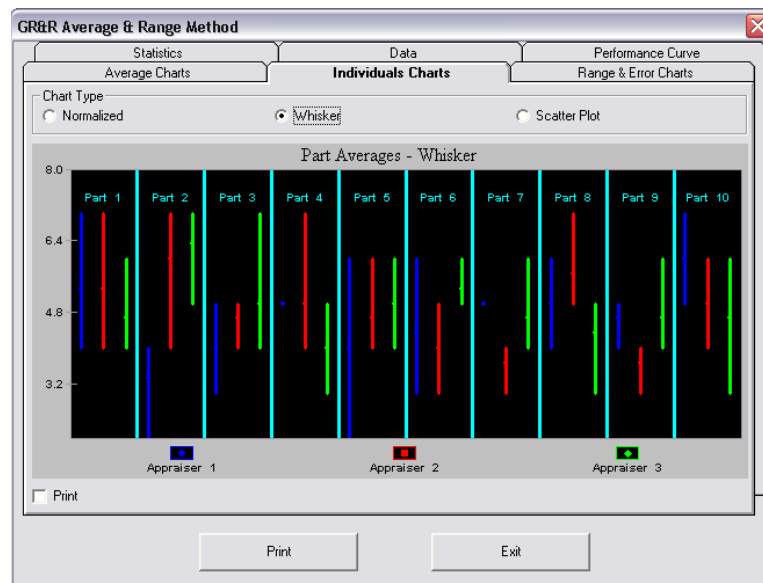
Normalized

Using the "normalized" option, scale is converted showing the grand average of all readings at 0. The high and low measurements for each appraiser and each part are plotted as a deviation from the grand average. The points for each operator are plotted in a different color and shape and connected by a line. One might expect as many as two dots at the extremes (high and low) of each operator for each part except when all measurements are the same for a given appraiser on a given part. In this (desirable) case only one dot will be plotted.



Whisker

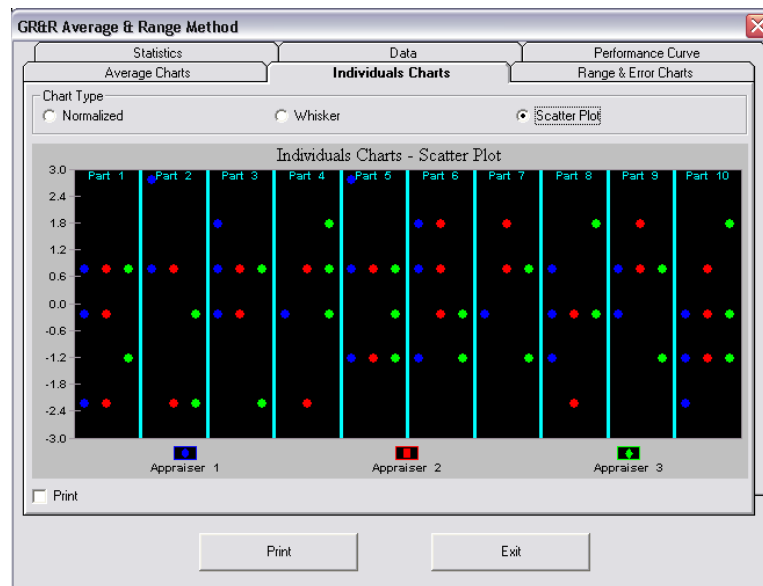
Using the “whisker” option, for each part, a line (whisker) connects the high and low values measured in the trials. The average is represented by a dot on this whisker line. It is similar to the normalized chart except the dot is located on the average and the connective line (whisker) emanates from there to the extreme values (high and low) for each appraiser’s samples.



Scatter Plot

Using the “scatter plot” option, values of all readings for each part are plotted minus the grand average. One might expect as many as three dots for each appraiser for each part. However, when measurements are the same for a given appraiser on a given part, two or three measurements may

appear as one dot. This is a desirable condition showing repeatability of the appraiser.

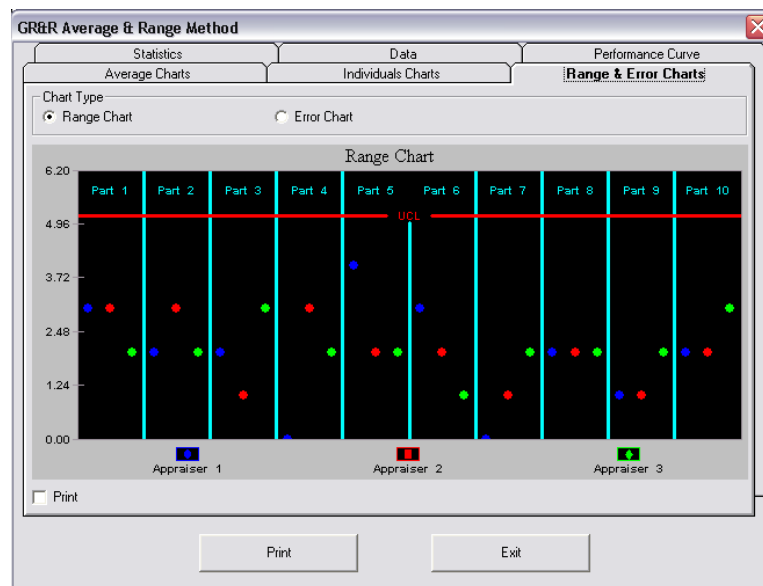


Range & Error Charts Tab

Option buttons include: range chart and error chart. This tab only applies to long variable studies.

Range Chart

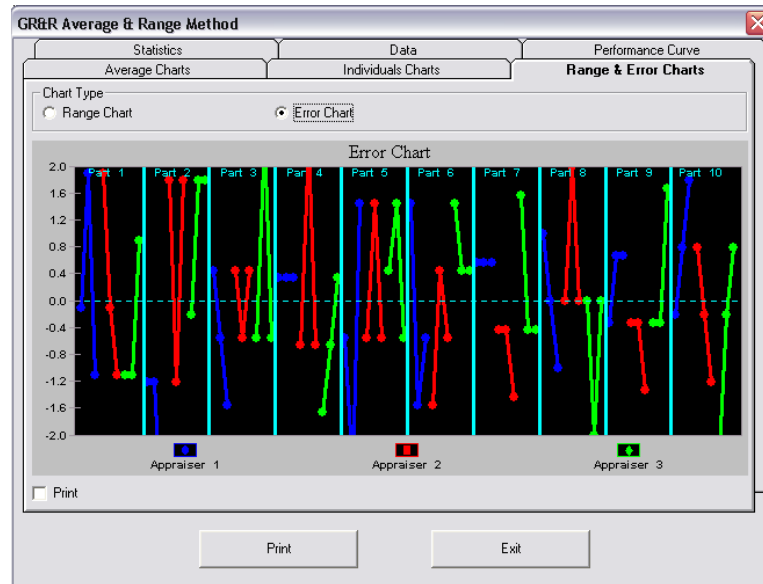
The "range chart" option shows the range of each operator's readings for each sample measured. In addition, a control limit is calculated and displayed. Note the control Limit calculation in Appendix A



Error Chart

On the “error chart”, individual deviation (error) for each part is plotted. Error in this case is calculated as observed value minus average measurement of the part. This analysis offers several good applications:

- One appraiser’s averages are higher than another
- An appraiser’s second reading is consistently lower than the others
- A particular part is difficult to measure consistently by all appraisers



5.2 Gage R&R Study

Once a new GR&R or GR&R-by type study is created or an existing study is opened, a “Gage Repeatability & Reproducibility Study” window similar to the one below opens (the appearance of the window may vary depending on whether it is a variable or attribute gage or due to other items such as the study type). If you created a new study based on a Study Definition, some of the fields will already be filled in.

Gage Repeatability & Reproducibility Study - Study Definition: 10Days

File Edit Analyze Instructions

Performed By: Date: 23/07/2010 Time: 17:45

Gage

Gage: Serial #: 12345
Category: Variable Type: Type1 (Locked)

Characteristic

Part: LSL: USL:
Characteristic: Category: Variable
Group: FirstCG (Locked)

Saved calculations

Calculation Method: Total Variation Method:

Study Parameters:

Appr #1: Appr #2: Appr #3:

Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #1 Trial #3	Appr #2 Trial #1	Appr #2 Trial #2	Appr #2 Trial #3	Appr #3 Trial #1	Appr #3 Trial #2	Appr #3 Trial #3
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Performed By Field and Button

Enter the name or initials of the supervisor overseeing the test in the “Performed by” field. You can type it in directly or select from a list by clicking the PERFORMED BY button.

Date

Enter the date the study was initiated in the “Date” field. The current system date is automatically entered into this field, but another date can be entered if desired.

Time

Enter the time the study was initiated in the “Time” field. The current system time is automatically entered into this field, but another time can be entered if desired.

Gage frame

In the Gage frame, click the Gage button to select a gage. The category of the gage will be shown (variable or attribute) in the frame and the Gage Type (if the gage is included in a Type). If you have not defined any gages you can just type in the name of the gage here.

If Study is based on a Study Definition and the gage is included in a Gage Type, then this study can be considered as representative of all the gages in the gage type. If one or more GR&R studies has been stored using the Study Definition, the Gage Type will become “locked”. This means that you can only change the specified gage to another gage in the Type.

Characteristic frame

If the program is being used in conjunction with DataLyzer Spectrum you can select a Datalyzer Part and Characteristic by clicking on the buttons. The Upper and Lower specification limits will be displayed along with the category of the characteristic (variable or attribute). If the characteristic is included in a characteristic group, the group will be also be shown.

If Study is based on a Study Definition and the selected characteristic is part of a characteristic group, then GR&R studies performed using this Study Definition can be considered as representative of all the characteristics in the group. If one or more GR&R studies has been stored using the Study Definition, the characteristic group will become “locked”. This means that you can only change the specified characteristic to another characteristic in the group.

If the program is not being used in conjunction with DataLyzer Spectrum, just type-in Part and Characteristic names. You can enter USL and LSL manually.

Tolerance (USL- LSL) is one of the Total Variation (TV) methods. Specification limits are not necessary in short attribute studies, and only one specification limit is needed for long attribute studies

Saved Calculations

This frame is for specifying the type of calculations (ANOVA or Average and Range) and total variation method that will be used for displaying results in the GR&R History screen and reports after it is saved. However, you can always view analysis based on ANOVA or Average and Range, with any available total variation method, by selecting items in the Analyze menu.

Average & Range Method (Long and Short Variable Studies)

The “Average & Range” method is the simple method used by AIAG in its SPC manual. It provides results for equipment variation (repeatability) and appraiser variation (reproducibility) only. It does not express interactions between appraiser variation and equipment variation.

ANOVA (Long Variable Studies)

The “ANOVA” (analysis of variance) method is a more accurate, more flexible method than the “Average & Range” method with no additional data entry requirements. ANOVA shows equipment variation (repeatability) and appraiser variation (reproducibility) and adds discrimination for the interactions between appraiser variation and equipment variation. The ANOVA method is similar to the ‘long variable study-average & range’ method and is the preferred method of GR&R analysis because it can handle any experimental setup (number or samples, operators, and trials), and it can estimate variances with higher bias, but the computation (handled by DataLyzer Spectrum Gage Management) and analyses are more complicated.

When conducting an ANOVA study, data entry must be randomized to be valid. Use the “randomized” data entry method. Operators will be prompted for measurements of pieces in a random order to ensure independent measurements. The draw-back to this is that all operators must be present at the time of the study where as you can enter data for one operator at time for Average & Range type studies.

Total Variation Method (Variable Gages Only)

The selection of the “Total Variation Method” is used along with the globally set “passing % error

limit" (located in SETUP, PREFERENCES) to determine if a gage passes or fails the R&R study. There are three options for this item:

Study Variation

Study variation is gage error expressed as a percent of total variation where total variation is estimated by the part variation found in the parts used in the study. Total study variation TV is similar to total process variation except that it uses part-to-part variation of parts used in the study to estimate variation of the manufacturing process.

Process Variation

Process variation refers to total variation in the manufacturing process. This is the Standard Deviation of the most recent one hundred measurements

Tolerance

Tolerance is gage error expressed as a percentage of engineering tolerance for the selected characteristic (i.e. percentage of the spec range being used by error in the gaging system). The engineering tolerance will be taken from values entered into the USL and LSL fields. If using a shared DataLyzer Spectrum SPC software these values will be filled in automatically.

Study Parameters

Clicking the Study Parameters button brings up the Study Parameters screen.

The screenshot shows the 'Study Parameters' dialog box. It has a title bar with 'Study Parameters' and a close button. The dialog contains the following elements:

- Radio buttons for 'Study Variation' (selected), 'GRR Attribute Study', 'Long Form' (selected), and 'Short Form'.
- Text input fields for 'Number of Appraisers' (value: 3), 'Number of Parts' (value: 10), and 'Number of Trials' (value: 3).
- Recommended ranges displayed to the right of the input fields: '2 to 4' for appraisers, '5 to 10' for parts, and '2 to 4' for trials.
- A section titled 'Data Entry Method' with radio buttons for 'Open Sheet' (selected), 'By Trial', and 'Randomized'.
- 'OK' and 'Cancel' buttons at the bottom right.

The study category (variable or attribute), and long or short form dictate what entries are acceptable in the "Number of Appraisers", "Number of Trials", and "Number of Parts" fields. The following list contains recommended values for the fields for each type of GR&R study. Some values are set and locked by the software, as indicated to force the study to conform to generally accepted rules.

Short Form Variable

The "Short Variable" study is the shortest and easiest variable GR&R study; however, it only provides an abbreviated picture of the measurement variability. It analyzes only appraiser variation (reproducibility) because the appraisers measure only one set of parts (one trial), then those results are compared against each other. This study requires two appraisers to make one measurement

each on the same characteristic for five parts. To begin the study, select five production parts at random (or of sizes ranging through the specifications) and any two operator/appraisers whose regular job it is to measure the parts from the process. Each appraiser should measure each part independently, so neither appraiser knows the results of the other's test (i.e. a blind test). The measurements are arranged in two columns so the results from each part are side by side. "Short Variable" studies are often preferred because they are quicker and easier than long variable studies. They save time for the operator and manager while still providing an indicator of the gage's reproducibility. Short variable studies always use the 'average & range' calculation method. Short variable studies will only show appraiser variation. When this study type is selected, the "Number of Appraisers", "Number of Trials", and "Number of Parts" fields will be set and locked by the software.

Long Form Variable

The long study has flexible parameters for number of operators, number of parts measured, and number of trials per part. We suggest using two or three appraisers/operators, each making two or three trial measurements on eight to ten sample products/characteristics. The sample products are chosen randomly from production parts (or organized by size ranging through the specifications). Appraisers are asked to make the desired number of measurements using their normal measuring techniques. Appraisers should take measurements independent of each other so results between appraisers have no influence on each other. The studies require significantly more sampling than the short studies, but they provide more detailed information regarding the type and amount of repeatability and reproducibility variation present in the measurement system. Two types of calculation methods are available for long variable studies: "average & range" and "ANOVA" (see the "Calculation Method" item for a description of these).

Long Form Attribute

The long attribute gage study is the most in-depth study and requires a substantial amount of time. The study consists of one operator making twenty measurements on 8-10 samples. Samples must be selected carefully. This study may be used on both single and double limit gages; however, in both cases only one limit must be examined at a time so their actual sizes are distributed symmetrically around the reference or true value. The smallest sample must have 0 accepts and at least six other parts must have 1-19 accepts. At least one sample with 20 accepts is also required.

The long attribute study analyzes around one spec. limit. The software will not allow data to be stored unless it meets the criteria of the study. If you try to store data that does not comply with what is required by the long attribute study definition, the software displays a window containing directions about how the sampling needs to be corrected. The long attribute study shows equipment variation only. It provides the following results on reports: gage performance curve plot, R=probability for repeatability at a given reference value, B=bias.

Short Form Attribute

The short attribute gage study evaluates go/no-go measurement systems. It involves two appraisers each taking two measurements on 20 sample parts. Some passing and some failing parts should be included in the samples. Both appraisers should measure all the parts once, and then repeat to measure all 20 parts again. If all four results for any sample do not match, the gage is not acceptable. Conversely, the gage is acceptable if all four trials agree for every sample. If the gage is judged to be unacceptable, it can be re-evaluated using this method if there is doubt about the results, or the gage can be re-evaluated using a more rigorous long form attribute study, or the gage should be repaired or replaced.

Number of Appraisers

Enter the number of operators to be included in the study in the “Number of Appraisers” field. In certain study types, the number of appraisers is set and locked by the software. See the table above for the number of appraisers recommended or allowed for the different study types. (Study validity depends on these appraisers being the same individuals who ordinarily measure production parts.)

Number of Parts

Enter the number of sample parts to be measured in the “Number of Parts” field. In certain study types, the number of parts is set and locked by the software. See the table above for the number of parts recommended or allowed for the different study types.

Number of Trials

Enter the number of trials to be included in the study in the “Number of Trials” field. “Trial” refers to the number of times a set of samples are measured. In certain study types, the number of trials is set and locked by the software. See the table above for the number of trials recommended or allowed for the different study types. (Study validity depends on these trials being conducted blindly so that appraisers do not know results from previous associated trials.)

Data Entry Method

The “Open Sheet” method can be used with all studies. The user can enter study data in any order.

The “By Trial” method can be used with long or short variable and short attribute studies. Using this method, all entries are made in one appraiser trial at a time (column-by-column). Data entry is organized by trial and must be entered in the order prompted by the system.

The “Randomized” method can be used with long or short variable and short attribute studies. For valid results, this method must be used for long variable studies using the ANOVA calculation method.

Data Entry Method and Data Spreadsheet

All Gage R&R studies should be done blind, i.e. organize the samples but do not mark them, so that on subsequent trials, the appraiser can not keep track of previous measurements on the same samples. Keep samples organized out of sight of the appraiser, so a specific pattern of trials can be followed.

The selection of data entry method, study type, calculation method (for attribute gages), number of appraisers, trials, and parts will affect how the data spreadsheet will appear.

When using “Randomized”, “By Trial”, or “Open sheet” methods, once data entry is complete, data can be viewed in the “data” tab under ANALYZE, ANALYSIS TOOLS in the “Gage Repeatability & Reproducibility Study” window or data can be viewed after calculations are complete by saving and exiting the gage study and then reviewing the study by using the EDIT/REVIEW STUDY button in the “GR&R History” window. If data needs to be edited because of user error or gage malfunction, save the study and open the study using the EDIT/REVIEW STUDY button in the “GR&R History” window; an open sheet is then available to edit all entries.

Randomized Method

The “Randomized” method can be used with long or short variable and short attribute studies. For valid results, this method must be used for long variable studies using the ANOVA calculation

method.

The “Randomized” entry spreadsheet looks something like this:

Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #1 Trial #3	Appr #2 Trial #1	Appr #2 Trial #2	Appr #2 Trial #3	Appr #3 Trial #1	Appr #3 Trial #2	Appr #3 Trial #3
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

To begin data entry, click the green START button in top left of the spreadsheet. The system will display a data entry window with an indicator as to which appraiser, trial, and part to measure. For variable gages, enter the value for the specified measurement and press OK. For attribute gages-short form, enter “G” for Go or Accept and “N” for No-Go or Not accept. The corresponding cell will turn green and the actual value will be internally stored in the database. The value will be hidden so it will not cause bias in later measurements.

By Trial Method

The “By Trial” method can be used with long or short variable and short attribute studies. Using this method, all entries are made in one appraiser trial at a time (column-by-column). Data entry is organized by trial and must be entered in the order prompted by the system.

The “By Trial” entry spreadsheet looks something like this:

Gage Repeatability & Reproducibility Study

File Edit Analyze Instructions

Performed By: Date: 26/07/2010 Time: 11:52

Gage:

Characteristic: LSL: USL:

Part:

Characteristic:

Saved calculations: Calculation Method: Average & Range Total Variation Method: Study Variation

Study Parameters: Variable - Long 3 Appraisers 10 Parts 3 Trials Data Entry Method - By Trial

Appr #1: Appr #2: Appr #3:

	Enter			Enter			Enter		
Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #1 Trial #3	Appr #2 Trial #1	Appr #2 Trial #2	Appr #2 Trial #3	Appr #3 Trial #1	Appr #3 Trial #2	Appr #3 Trial #3
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

To begin, click the green ENTER button at the top of the first column. The system will display a data entry window with an indicator as to which appraiser, trial, and part to measure. For variable gages, enter the value for the specified measurement and press OK. For attribute gages-short form, enter "G" for Go or Accept and "N" for No-Go or Not accept. The corresponding cell will turn green and the actual value will be internally stored in the database. The value will be hidden so it will not cause bias in later measurements.

Open Sheet

The "Open Sheet" method can be used with long or short variable and short attribute studies. The "Open Sheet" entry spreadsheet looks something like this:

Gage Repeatability & Reproducibility Study

File Edit Analyze Instructions

Performed By: Date: 26/07/2010 Time: 11:52

Gage:

Characteristic: LSL: USL:

Part:

Characteristic:

Saved calculations:

Calculation Method: Total Variation Method:

Study Parameters:

Appr #1: Appr #2: Appr #3:

Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #1 Trial #3	Appr #2 Trial #1	Appr #2 Trial #2	Appr #2 Trial #3	Appr #3 Trial #1	Appr #3 Trial #2	Appr #3 Trial #3
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

To use this method, enter values in the spreadsheet, in any order, until the form is complete. For variable gages, enter the value for the specified measurement. For attribute gages-short form, enter "G" for Go or Accept and "N" for No-Go or Not accept. "Open sheet" is the most flexible data entry method.

Long Attribute

The long attribute study uses a special spreadsheet for data entry.

It looks like this:

Part	Size	Accepts	P
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Run each sample through the attribute gage 20 times and record the dimension (size) and enter the number of accepts for each size in the corresponding "Accepts" field. The whole study should have at least one sample within the gage's limit with a result of "Go" for all 20 samples, and the study should include at least one sample outside the gage's limits resulting in 20 "No Go" entries. Results between the two extremes should have a variable number of acceptances. It is required that at least six samples be measured where the number of acceptances is between 1 and 19. If the originally selected pieces do not yield 6 samples with 1-19 acceptances, choose more samples from the process with different measurements (taken by the variable gage). The "P" column is used to show the estimated probability of acceptance and is calculated after data entry.

File Menu - Save or [F2]

The SAVE item (or pressing [F2] without opening the menu) saves the changes made or data entered to the study.

File Menu - Save & Exit or [Ctrl]+[S]

The SAVE & EXIT item (or pressing [Ctrl]+[S] without opening the menu) saves the changes made or data entered to the study and closes the study window.

File Menu - Exit

The EXIT item closes the study window without saving any entered data or changes.

Analyze Menu - Preview or [F5]

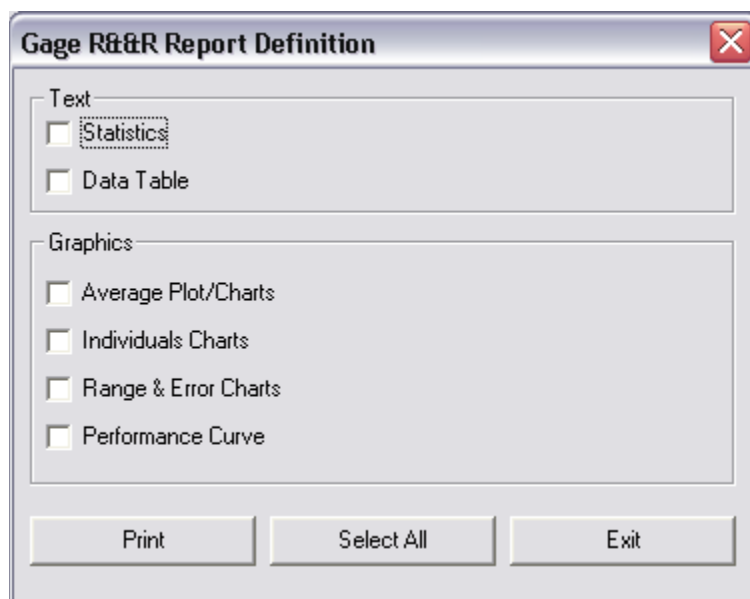
The PREVIEW item (or pressing [F5] without opening the menu) will open a report preview window for the current study. A full description of the report can be found in Reports Menu. You can PRINT or EXIT the report from the FILE menu in this window.

Analyze Menu - Analysis Tools or [F6]

This opens the Analysis Tools window.

5.3 GR&R Report Definition

This window appears if you attempt to print from the GR&R Analysis Tools window and none of the tabs have the Print checkbox checked.



Select the aspects of the report you wish to print. You will build a report by checking all items to be included in the report. Each check box will cause an associated set of information up to 1/2 page in size to be included in the printed report. Therefore, if all the sections are selected, the report will be about three pages in length.

Text Area

Statistics Checkbox

Marking the “statistics” checkbox will list all statistics and show calculations associated with the study on the report.

Data Table Checkbox

Marking the “data table” checkbox will include a complete data table in the report.

Graphics Area

Use the checkboxes in the graphics area to select the items you would like to include in the report. The “average plot/charts”, “individuals charts”, “range & error charts”, and “performance curve” checkboxes apply to long variable studies. The “average plot/charts” item applies to ANOVA studies.

Print Button

Press the PRINT button to print the report.

Exit Button

The EXIT button closes the window without printing.

5.4 Calibration Study

Use the ENTER/EDIT-CALIBRATION item in the DATA menu to define and enter, review, or edit gage calibration study information for an individual gage.

Simple Mode

The screenshot shows a software window titled "Calibration Study" with a menu bar (File, Edit, Reports). The window contains several input fields and buttons. On the left, there is a "Performed by:" button and a text field containing "First Inspector". Below this are fields for "Gage Name:" (containing "FirstGTFirstGage"), "Gage Type:" (containing "First GT"), and "Description:" (containing "Description"). At the bottom left is a "Certificate Scan" section with a "Browse..." button. On the right, there are fields for "Date:" (containing "07/04/2010"), "Time:" (containing "14:06"), "Manufacturer:" (containing "Acme Calibration"), "Model:" (containing "Model"), "Serial Number:" (containing "Serial No"), and "Company Number:" (containing "Company No"). Below these is a "Status:" field with a green button labeled "PASS" and a "Set" button. At the bottom right is an "Advanced" button.

When a calibration study is started, the Calibration Study displays simple mode. Simple mode is for situations where there is no need to record calibration data, other than the date and whether the study is Pass or Fail.

Performed By Field and Button

Enter the name or initials of the supervisor overseeing the test in the "Performed by" field. You can type it in directly or select from a list by clicking the PERFORMED BY button.

Gage Name

The "Gage Name" field displays the gage name. The contents of this field cannot be changed.

Gage Type

The "Gage Type" field displays the gage type as specified in the gage's "gage description" window. It cannot be changed here.

Date

Enter the date the study was initiated in the "Date" field. The current system date is automatically entered into this field, but another date can be entered if desired.

Time

Enter the time the study was initiated in the “Time” field. The current system time is automatically entered into this field, but another time can be entered if desired.

Serial Number

The “Serial Number” field is automatically filled-in based on the serial number entered in the gage’s “gage description” window. It cannot be changed in this window.

Company Number

The “Company Number” field is automatically filled-in based on the company number entered in the gage’s “gage description” window. It cannot be changed in this window.

Status Field and Set button

In simple mode the status Set button is available to manually set the status. Three statuses are available, “Pass”, “Fail” and “Not Set”.

Certificate Scan Frame

This frame provides a way to view a calibration certificate for the study. Make a file of the certificate using a scanner, for example a jpeg or jpg file type and store it in a known location of the computer. Click the Browse button to locate the file. This location will be stored in the database. To view the certificate click on the Show button.

Advanced Mode

Clicking the Advanced button reveals a tabbed section which contains more fields for the Calibration study

The screenshot shows the 'Calibration Study' window with the following fields and controls:

- File Edit Reports** (Menu bar)
- Calibration number:** 000001
- Date:** 07/04/2010
- Time:** 14:06
- Performed by:** First Inspector
- Manufacturer:** Acme Calibration
- Gage Name:** FirstGTFirstGage
- Model:** Model
- Gage Type:** First GT
- Serial Number:** Serial No
- Description:** Description
- Company Number:** Company No
- Status:** (Dropdown menu) **Set** (Button)
- Certificate Scan:** **Show** (Button) **Browse...** (Button)
- Calibration Datasets:** **Add** (Button) **Simple** (Button)
- Study Details** (Tab)
- Resolution:** (Field)
- Precision:** (Field)
- Range:** (Field)
- Units:** (Field)
- Temperature:** (Field)
- Humidity:** (Field)
- Barometer:** (Field)
- Instructions** (Button)
- Notes:** (Text area)

Resolution, Precision, Range, Units

These fields are automatically filled-in based on entries in the gage's "gage description" window. They cannot be changed in this window.

Temperature

Enter the ambient temperature when the study is performed in the "Temperature" field.

Humidity

Enter the ambient humidity when the study is performed in the "Humidity" field.

Barometer

Enter the barometric pressure when the study is performed in the "Barometer" field.

Notes

You can use the "Notes" field to enter comments such as the condition or other aspects of the gage being studied.

Instructions Button

When you press the Instructions button, the Measuring Instructions window will appear showing any measuring instructions and attachments that were defined on the gage's "gage description" window.

Calibration Datasets Frame

This frame controls the creation and removal of "Calibration Datasets". A calibration dataset is a table like a spreadsheet where reference values and measurements can be entered for determining the bias throughout a measurement mode of a gage. Because a gage can have more than one measurement mode (e.g. inside diameter, outside diameter, depth), you can have more than one calibration dataset in a calibration study.

When a study has one or more Calibration Datasets, the study status (pass, fail, or not set) is automatically calculated from the measurements in the datasets, it cannot be set manually.

When you add a calibration dataset, the Calibration Dataset Design window opens.

The Dataset Table

The following shows the data entry area for a typical Calibration Dataset. The columns that appear are determined by the Dataset window described above. Fields for user entry are white, other fields show calculated results.

Study Details Outside Diameter

Title: Outside Diameter Graph Tolerance +: .02

Master: First Master SN: 12345 Tolerance -: .02

	Nominal	Meas 1	Meas 2	Meas 3	Average	Bias	Meas U	Master U	Status
1	2.001	2.005	2.01	2.002	2.0057	0.0047	0.0081	.001	PASS
2	3.98	3.99	3.981	3.986	3.9857	0.0057	0.009	.002	PASS
3	6.03	6.028	6.033	6.027	6.0293	-0.0007	0.0064	.002	PASS
4	8.02	8.025	8.017	8.022	8.0213	0.0013	0.0081	.004	PASS
5	9.96	9.97	9.965	9.963	9.966	0.006	0.0072	0.013	FAIL

Title

Enter a title for the dataset. This title will also appear on the tab.

Tolerance + and -

Enter the permitted positive and negative tolerances for the measurement mode. Calculated fields in the data entry spreadsheet are displayed to two more decimal places than the number of decimal places shown in the tolerance fields. For example, if you set a tolerance to "0.20" calculated fields will display to four decimal points.

Master Button and Fields

To enter a master block set in the "Master Set" field, press the MASTER button and select a master from the list that appears. The masters in this list are defined under SETUP, DEFINE MASTER in the main program window. Text included in the Notes field for the master will be printed on the calibration certificate.

Table columns

Nominal - The reference or known value of the master block or characteristic used for the calibration point

Meas - The gage measurement(s)

Average - (calculated) The average of all the measurements for the calibration point

Bias - (calculated) = Average minus Nominal

Meas U - (calculated). Uncertainty of measurements = 2 times the standard deviation of measurements for the calibration point

Master U - This column is for any additional uncertainty you might know about (uncertainty of Nominal value for example)

Status - (calculated)

Not set (dark grey), some values for the calibration point are missing

Fail if Bias plus Total Uncertainty is greater than positive tolerance OR Bias minus Total Uncertainty is lower than negative tolerance.

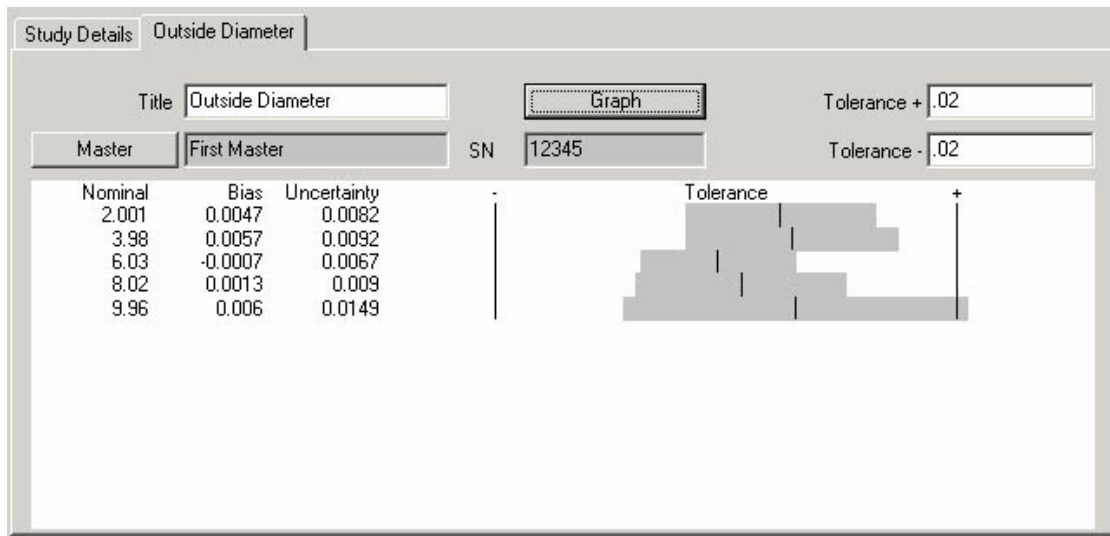
Pass if Bias plus Total Uncertainty is less than positive tolerance AND Bias minus Total Uncertainty is greater than negative tolerance.

Total Uncertainty = Square root of (Meas U squared plus Master U squared). If the Meas U or Master U column is not showing in the table, the relevant value is taken as zero.

Note: Status for the whole study is Fail if any calibration point in any calibration dataset is Fail. Status for the study is Pass if all calibration points in all calibration datasets are Pass. If data is incomplete and no calibration points are Fail then the status for the study is Not Set.

Graph

Click the Graph button with the mouse and hold down the left mouse key. This shows a simple graphic of the results for each calibration point.



The Nominal and Bias figures are copied from the spreadsheet. The Uncertainty column is a calculation of the Combined Uncertainty (calculations shown above). In the graphic on the right the minus and plus tolerances are shown as vertical lines. For each calibration point the bias (black line) and Combined Uncertainty (grey bar) are shown. If either of these are outside the tolerance limits the calibration point has status "Fail".

5.5 Calibration Label

This opens a window for printing calibration labels on A4 or similar sheets of peel-off labels. Select a study by clicking in its study number field in the Calibration History window. The row will highlight to show it is selected. Select **LABEL PRINT** from the **FILE** menu to print a calibration label for the selected study.

The screenshot shows the 'Print calibration label' dialog box. It has two tabs: 'Print Label' and 'Print Setup'. The 'Print Label' tab shows options for label position (Horizontal/Vertical), label title, and font. The 'Print Setup' tab shows a list of fields to include on the label.

Print Label Tab:

- Label Position: Horizontal (1), Vertical (3)
- Auto Increment: ☒
- Label Title: Calibration
- Font: [Font button]

Print Setup Tab:

- Fields:
 - ☒ Calibration Number
 - ☒ Calibration Date
 - ☒ Calibration Status
 - ☒ Inspector
 - ☐ Gage Name
 - ☐ Description
 - ☐ Model
 - ☐ Serial Number
 - ☐ Company Number
 - ☒ Calibration Due
- Font: [Font button]

Buttons: Print, Close

If you have not previously printed labels using the type of label sheet, click the **Print Setup** tab and

enter measurements for the type of label sheet you are using. After entering the measurements click the Print Label tab.

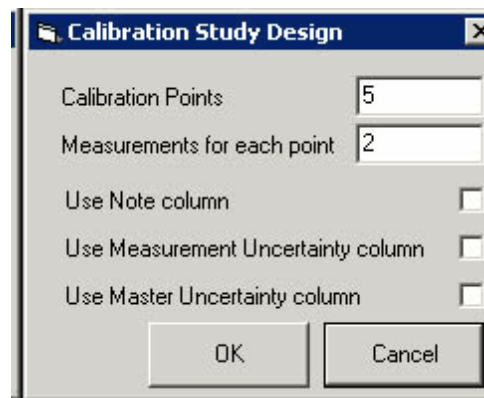
In the **Label Position** frame indicate the label on the sheet that you want to print on by clicking the Horizontal and Vertical + or – buttons. If the **Auto Increment** box is checked the printing position will move after a label has been printed.

The **Label Title** is printed centrally at the top of the label. The **Font** button allows you to change the printed font for the label title.

The **Fields** frame is for selecting the information that you want to appear on the label. The **Font** button allows you to change the printed font for this information. You may need to change the font size to ensure that there is room on the label for all the selected fields.

5.6 Calibration Dataset Design

When you add a calibration dataset, the study design window opens.



Calibration Points

Typically, you will calibrate at more than one point within the gage's range to check for bias throughout its entire range called "linearity". Enter the desired number of calibration points (typically 3-8) in the Calibration Points" field.

Measurements for each point

Enter the desired number of measurements that will be performed for each calibration point. If this number is greater than one they will be averaged to determine the gage's bias for the calibration point.

Use Note column

If you check this box a column in the spreadsheet will be added for miscellaneous notes about the calibration point (for example, the master blocks stacked to create the reference value).

Use Measurement Uncertainty column

If the number of measurements for each calibration point is greater than 1, the Use Measurement

Uncertainty column checkbox appears. If it is checked a column appears in the spreadsheet showing the measurement uncertainty. This is a calculated column based on the variation of the individual measurements. This uncertainty is taken into account when determining the status of the calibration point. If there is no uncertainty column then pass or fail is calculated from a simple average.

Use Master Uncertainty column

If this checkbox is checked a Master Uncertainty column appears in the spreadsheet. The value in this column is input by the user representing uncertainty of the reference value. This uncertainty is taken into account when determining the status of the calibration point. If there is a Measurement Uncertainty column and a Master Uncertainty column in the spreadsheet, then the values are combined together to make a Total Uncertainty figure.

5.7 Measuring Instructions - Read

The Measuring Instructions windows is in Read mode if it is opened during a Calibration or R&R study.

Example calibration gage : GR&R Attachments

GR&R Measuring Instructions:

GR&R Control Plan Reference:

Attachment 1

Attachment 2

Attachment 3

Attachment 4

Attachment 5

OK

Measuring Instructions Field

The “Measuring Instructions” field shows instructions or procedures about conducting studies. Different instructions are stored for Calibration and GR&R studies.

Control Plan Reference

The “Control Plan Reference” field offers control plan cross-reference.

File Attachment Buttons

If attachments were included when the gage was defined, each of the five ATTACHMENT buttons may link to a file or website to help describe procedures or work instructions for doing a study. Buttons with attachments will display the name of the linked file or website inside the label of the button; clicking on the button will cause the system to follow the link and display the “attached” file or website that is linked to it.

5.8 Bias Study

The Bias Study window looks like this:

The screenshot shows the "Bias Data" window with the following fields and controls:

- File Reports** (Menu)
- Performed By:** (Dropdown button)
- Part** (Text field)
- Characteristic** (Text field)
- LSL:** (Text field)
- USL:** (Text field)
- Date:** 6/10/2008
- Time:** 11:18
- Location:** (Text field)
- Gage Name:** 0-1 caliper
- Gage Type:** caliper (Dropdown)
- Serial Number:** (Text field)
- Notes:** (Large text area)
- Instructions:** (Text field)
- Process Variation:** (Text field)
- Observed Average:** (Text field)
- Bias:** (Text field)
- % Bias:** (Text field)
- Table:**

#	Master	1	2	3	4	5	6	7	8	9	10
Reading											

Performed By Field and Button

Enter the name or initials of the supervisor overseeing the test in the “Performed by” field. You can type it in directly or select from a list of previously entered names by clicking the PERFORMED BY button.

Part Field and Button

Enter the part name or part number being studied in the “Part” field. You can type it in directly; or, if sharing a DataLyzer Spectrum SPC software database, you can select a part from a catalog of all existing DataLyzer Spectrum parts from the SPC system (complete with data group options) by pressing the PART button. Using the part and characteristic entry the USL and LSL can be referenced in the associated DataLyzer® SPC system to allow the calculation of %bias. If no DataLyzer® SPC system is present then you can enter the part and characteristic information for reference but you will also need to enter the USL and LSL or process variation range for a % bias value to be calculated.

Characteristic Field and Button

Enter the characteristic being studied in the “Characteristic” field. You can type it in directly; or, if sharing a DataLyzer Spectrum SPC software database, you can select it from a catalog of characteristics from the selected part by pressing the CHARACTERISTIC button. If no part was specified in the “Part” field, you will first be prompted to select a part. A different characteristic can be assigned to each individual gage study.

LSL and USL

If you are sharing an SPC DataLyzer database and have assigned a specific characteristic to the study, both the lower and upper specifications will be filled-in automatically from the characteristic you selected. Otherwise, type in the upper and lower specification limits for the characteristic into the “LSL” and “USL” fields. Once data is saved in the study or a characteristic is assigned to the study, the specification limits are locked and cannot be changed.

Date

Enter the date the study was initiated in the “Date” field. The current system date is automatically entered into this field, but another date can be entered if desired.

Time

Enter the time the study was initiated in the “Time” field. The current system time is automatically entered into this field, but another time can be entered if desired.

Location

Enter where the bias study is performed in the “Location” field.

Gage Name

The “Gage Name” field displays the gage name. The contents of this field cannot be changed.

Gage Type

The “Gage Type” field displays the gage type as specified in the gage’s “gage description” window. It cannot be changed here.

Serial Number

The “Serial Number” field displays the serial number as specified in the gage’s “gage description” window. It cannot be changed here.

Notes

You can use the “Notes” field to enter comments such as the condition or other aspects of the gage being studied.

Instructions Button

When you press the Instructions button, the Instructions window will appear providing any measuring instructions and attachments that are defined on the gage’s “gage description” window.

Process Variation

In the “Process Variation” field, enter the value for either 6sigma of the process or tolerance, whichever you want to measure the bias against.

Observed Average

After the study is saved, the “Observed Average” field will display the average of the 10 samples entered.

Bias

After the study is saved, the “Bias” field will display the difference between the master value and the observed average. The bias value from the most recent bias study is used in calculations for the Performance Curve of the gage.

% Bias

After the study is saved, the “% Bias” field will display the percent of the process being used by gage bias $[(\text{bias} / \text{process variation}) * 100]$.

Data Entry Spreadsheet

To enter data, in the “Master” cell, enter the value of the master being measured. The master is often a part of known dimension, but can be a standard (like a gage block) that is similar in size to a production part such that it is reasonable to assume similar results from measuring the standard or a production part. Measure the master 10 times and enter the results into cells 1-10. Blind studies are the best way to avoid bias.

File Menu - Save or [F2]

The SAVE item (or pressing [F2] without opening the menu) saves the changes made or data entered to the study.

File Menu - Save & Exit or [Ctrl]+[S]

The SAVE & EXIT item (or pressing [Ctrl]+[S] without opening the menu) saves the changes made or data entered to the study and closes the study window.

File Menu - Exit

The EXIT item closes the study window without saving any entered data or changes.

Reports Menu - Print or [F6]

The PRINT item (or pressing [F6] without opening the menu) will print the report.

Part

VI

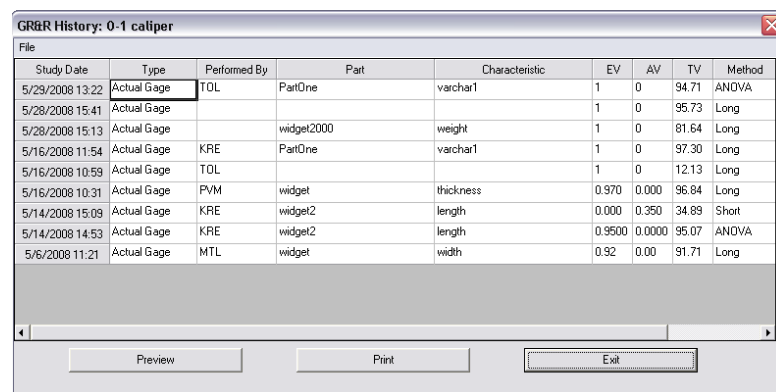
6 Reports - (Reports Menu)

The following procedure is used for printing Gage R&R study, Gage Calibration (certificate of calibration), and Performance reports.

Select the type of report to be printed (GAGE R&R STUDY, GAGE CALIBRATION, PERFORMANCE) from the REPORTS menu. The “Gage catalog” window will then appear; select the desired gage from the gage catalog.

After you have selected a gage, a “history” window will appear containing all studies performed for the report type selected. The studies will be sorted by date and time with the most recent on top. (If no studies exist in the list, no studies have been performed for this gage.)

The history window that appears for printing GR&R studies and performance reports looks like this:

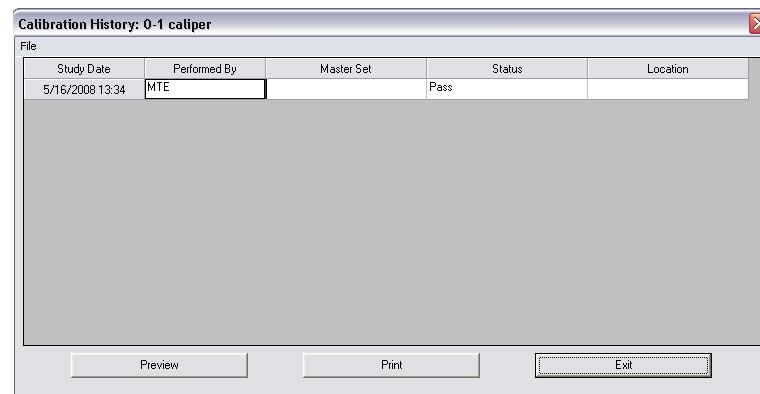


GR&R History: 0-1 caliper

Study Date	Type	Performed By	Part	Characteristic	EV	AV	TV	Method
5/29/2008 13:22	Actual Gage	TOL	PartOne	varchar1	1	0	94.71	ANOVA
5/28/2008 15:41	Actual Gage				1	0	95.73	Long
5/28/2008 15:13	Actual Gage		widget2000	weight	1	0	81.64	Long
5/16/2008 11:54	Actual Gage	KRE	PartOne	varchar1	1	0	97.30	Long
5/16/2008 10:59	Actual Gage	TOL			1	0	12.13	Long
5/16/2008 10:31	Actual Gage	PVM	widget	thickness	0.970	0.000	96.84	Long
5/14/2008 15:09	Actual Gage	KRE	widget2	length	0.000	0.350	34.89	Short
5/14/2008 14:53	Actual Gage	KRE	widget2	length	0.9500	0.0000	95.07	ANOVA
5/6/2008 11:21	Actual Gage	MTL	widget	width	0.92	0.00	91.71	Long

Buttons: Preview, Print, Exit

The history window that appears for printing calibration reports looks like this:



Calibration History: 0-1 caliper

Study Date	Performed By	Master Set	Status	Location
5/16/2008 13:34	MTE		Pass	

Buttons: Preview, Print, Exit

The spreadsheet areas of these windows are described in Chapter 4 – Data.

Select the desired study by clicking on it. You can then print the study using the PRINT button or FILE, PRINT menu item. You can preview the study using the PREVIEW button or FILE, PREVIEW menu item. Close the history window by using the EXIT button or FILE, EXIT menu item.

6.1 Gage R&R – Long Variables – Average & Range

The preview window for long variable GR&R studies done using the “average & range” calculation method looks like this:

GR&R Report

File Variables

Stephen Computer Services, Inc.

GR&R AVERAGE & RANGE REPORT

Part No. & Name: PartOne Gage Name: 0-1 caliper Study Date: 5/16/2008
 Characteristic: varchar1 Gage No.: 8878M03 Performed By: KRE
 Specifications: 0 - 10 Gage Type: caliper
 User Field 1

From data sheet: $\bar{R} = 2.0000$ $\bar{X}_{DIFF} = 0.2000$ $R_p = 0.8889$

Measurement Unit Analysis			% Total Variation (TV)
Repeatability - Equipment Variation (EV) $EV = \bar{R} \times K_1 = 2.0000 \times 3.05$ $= 6.1000$	Trials 2 3 4	K₁ 4.56 3.05 2.50	% EV = 100 (EV / TV) $= 100 (6.1000 / 6.2677)$ $= 97.32\%$
Reproducibility - Appraiser Variation (AV) $AV = \sqrt{(\bar{X}_{DIFF} \times K_2)^2 - (EV^2 / nr)}$ $= \sqrt{(0.2000 \times 2.70^2) - (6.1000^2 / (10 \times 3))}$ $= 0.0000$	Appraisers 2 3 4	K₂ 3.65 2.70 2.50	% AV = 100 (AV / TV) $= 100 (0.0000 / 6.2677)$ $= .00\%$ n = Number of Parts r = Number of Trials
Repeatability & Reproducibility (R&R) $R\&R = \sqrt{EV^2 + AV^2} = \sqrt{6.1000^2 + 0.0000^2}$ $= 6.1000$	Parts 2 3 4 5 6 7 8 9 10	K₃ 3.65 2.70 2.50 2.08 1.93 1.82 1.74 1.67 1.62	% R&R = 100 (R&R / TV) $= 100 (6.1000 / 6.2677)$ $= 97.32\%$ % PV = 100 (PV / TV) $= 100 (1.4400 / 6.2677)$ $= 22.98\%$
Part Variation (PV) $PV = R_p \times K_3 = 0.8889 \times 1.62$ $= 1.4400$			
Total Variation (TV) $TV = \sqrt{R\&R^2 + PV^2} = \sqrt{6.1000^2 + 1.4400^2}$ $= 6.2677$			

All calculations are based upon predicting 5.15 sigma (99.0% of the area under the normal distribution curve).
 K1 is 5.15/d2, where d2 is dependent on the number of trials (n) and the number of parts times the number of appraisers (g) which is assumed to be greater than 15.
 AV - If a negative value is calculated under the square root sign, the appraiser variation (AV) defaults to zero (0).
 K2 is 5.15/d2 where d2 is dependent on the number of appraisers (m) and (g) is 1, since there is only one range calculation.
 K3 is 5.15/d2 where d2 is dependent on the number of parts (m) and (g) is 1, since there is only one range calculation.
 d2 is obtained from Table D3, "Quality Control and Industrial Statistics," A.J. Duncan.

Print the report using the FILE, PRINT menu item. Close the report preview window by using the FILE, EXT menu item.

Report Header

The header of the report contains information about the gage used and the characteristic defining the study.

Statistics from the data sheet include:

$\bar{R}$ double bar = Average of each range calculated from each part trial - all appraisers, all trials

$\bar{X}$ bar Diff = Average from each trial all averaged for each appraiser. The minimum of these averages is subtracted from the maximum of these averages.

R_p = (Part/Trial average maximum) – (Part/Trial average minimum) = range for the entire study

Measurement Unit Analysis Area

Repeatability - Equipment Variation (EV)

$$EV = \bar{\bar{R}} \times K_1 \quad \bar{\bar{R}} \text{ from datasheet}$$

K_1 is associated with the number of trials in the study

Reproducibility - Appraiser Variation (AV)

$$AV = (\bar{X}_{DIFF} \times K_2)^2 - \sqrt{\frac{EV^2}{(\# \text{ parts}) \times (\# \text{ trials})}}$$

$\bar{X}_{DIFF}$ from datasheet

K_2 is associated with the number of appraisers in the study

Repeatability & Reproducibility (R&R)

$$R\&R = \sqrt{EV^2 + AV^2}$$

Part Variation

$$PV = R_P \times K_3$$

R_P from datasheet

K_3 associated with the number of parts in the study

Total Variation (TV)

Total variation can be based on one of three different statistics

Study Variation

$$TV = \sqrt{R\&R^2 + PV^2}$$

Process Variation

$$TV = \sqrt{R\&R^2 + PV^2} \quad 6\sigma \text{ of the manufacturing process}$$

Tolerance

TV = USL - LSL

% Total Variations (TV) Area

%EV = 100(EV/TV) or 100(EV/SV) or 100(EV/TOL) depending on which was selected in study setup

%EV = 100 (EV/TV) where TV could be variation found in this R&R Study or +/- 3sigma of the most recent SPC data or Percent of Tolerance depending on which one was selected when the study was setup.

%AV = 100(AV/TV) or 100(AV/SV) or 100(AV/TOL) depending on which was selected in study setup

%AV = 100 (AV/TV) where TV could be Study variation, +/- 3sigma of the most recent SPC data or % of Tolerance depending on which one was selected when the study was setup.

%R&R = 100(R&R/TV) or 100(R&R/SV) or 100(R&R/TOL) depending on which was selected in study setup

Variables Menu Item

When you access the VARIABLES menu item from the report preview window, a window will appear containing a spreadsheet of the data used in the study.

It looks like this:

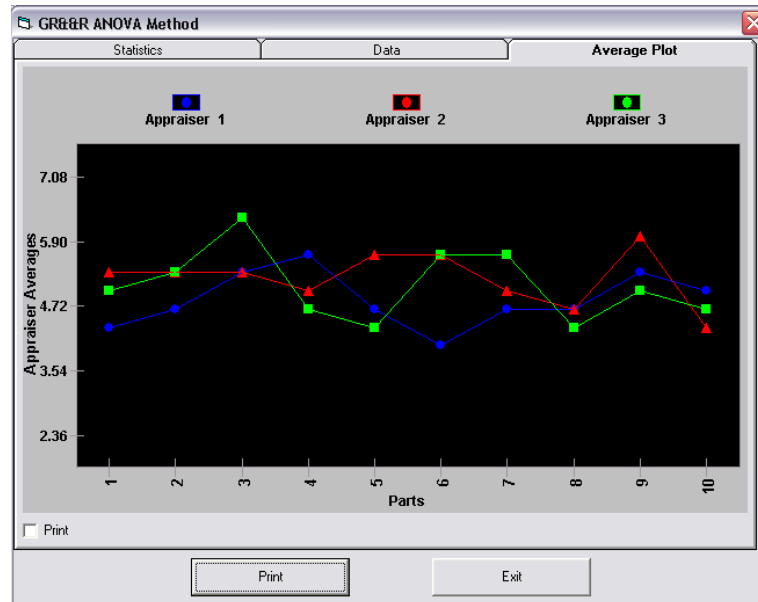
Appraisers	Part: 1	Part: 2	Part: 3	Part: 4	Part: 5	Part: 6	Part: 7	Part: 8	Part: 9
Appraiser: 1									
Trial #: 1	0.56	0.57	0.83	0.61	0.58	0.62	0.67	0.70	0.56
Trial #: 2	0.62	0.65	0.63	0.54	0.59	1.00	0.61	0.62	0.63
Trial #: 3	0.64	0.61	0.65	1.00	0.51	0.52	0.57	0.72	0.60
Average:	0.61	0.61	0.70	0.72	0.56	0.71	0.62	0.68	0.60
Range:	0.08	0.08	0.20	0.46	0.08	0.48	0.10	0.10	0.07
Appraiser: 2									
Trial #: 1	0.55	1.00	0.68	0.58	0.54	0.64	0.53	0.81	1.00
Trial #: 2	0.52	1.00	0.57	0.56	0.60	0.61	0.61	0.57	1.00
Trial #: 3	0.60	1.00	0.63	0.65	0.58	0.59	0.60	0.58	1.00
Average:	0.56	1.00	0.63	0.60	0.57	0.61	0.58	0.65	1.00
Range:	0.08	0.00	0.11	0.09	0.06	0.05	0.08	0.24	0.00
Appraiser: 3									

The data table can be printed using the PRINT option in the FILE menu. Close the window by using the FILE, EXIT menu item. To copy from this window, highlight the desired cells and press [Ctrl]+[C] on the keyboard and then press [Ctrl]+[V] to paste into a spreadsheet or other document.

6.2 Gage R&R – Long Variables – ANOVA

The “average plot” tab applies only to ANOVA studies.

The purpose of the “averages plot” graph is to show potential differences in reproducibility between operator averages for the same part. Option buttons designate which one of three graphical analyses will be displayed. They include: runs chart, averages chart, and X-Y plot.



6.3 Gage R&R – Short Variables

The preview window for short variable GR&R studies done using the “average & range” calculation method looks like this:

GR&R Report			
Stephen Computer Services, Inc.			
GR&R AVERAGE & RANGE REPORT			
Part No. & Name:	wdget2	Gage Name:	0-1 caliper
Characteristic:	length	Gage No.:	8876M09
Specifications:	5.000 - 0.100	Gage Type:	caliper
		Date:	5/14/2008
		Performed By:	KRE
Measurement Unit Analysis			
Parts	Appraiser A	Appraiser B	Range(A-B)
1	2.354	3.6857	1.332
2	3.654	4.974	1.32
3	1.688	3.7111	2.023
4	2.697	2.499	0.198
5	4.414	1.784	2.63
Average Range			1.501
GR&R = 6.49419			

Equipment variation (repeatability) is not allowed because only one trial per operator is involved. ANOVA analysis is not supported on short variables studies.

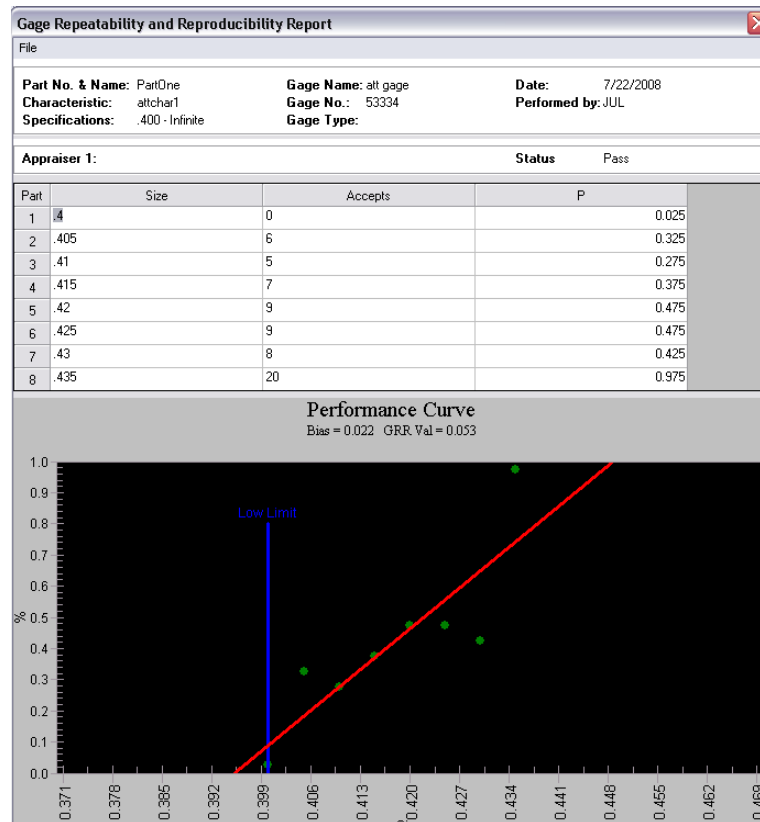
$$\text{Average Range} = \sum R_i / 5$$

$$\text{GR\&R} = \bar{R} / d_2$$

$$\% \text{GR \& R} = 100 \times \left(\frac{\text{GR\&R}}{\text{process standard deviation}} \right)$$

6.4 Gage R&R – Long Attribute

The preview window for long attribute GR&R studies looks like this:



Eight parts must be selected each with a unique size. The largest and smallest can pass 100% and fail 100% but the other parts must not pass the gage system 100%. The gage must sometimes accept and other times reject these parts during the 20 trials.

The probability of accepting each size is calculated:

a= number of accepted parts from the 20 measured

m= number of parts measured of that size

$$\frac{(a + .5)}{m} = \text{Probability of acceptance, if } a/m < .5, a \neq 0$$

These are the values in the P column

$$\frac{(a - .5)}{m} = \text{Probability of acceptance, if } a/m > .5, a \neq 20$$

These are the values in the P column

.5 = Probability of acceptance, if $a/m = .5$

These are the values in the P column

$$\text{Repeatability} = \frac{(X_i \text{ at } P = .995) - (X_i \text{ at } P = .005)}{\text{Bias}}$$

$$\text{Bias} = \text{Lower Limit} - \bar{X}_i \text{ (at } P = .5)$$

To calculate whether the bias is significantly different than zero

$$t = \frac{31.3 \times \text{Bias}}{\text{Repeatability}}$$

Compare this result with the critical value in t distribution table for .025 or .975 and number of samples you are testing minus 1 (degrees of freedom). If the calculated t value for this study is greater than the critical t value found in the table, then bias in this study is significant.

6.5 Gage R&R – Short Attribute

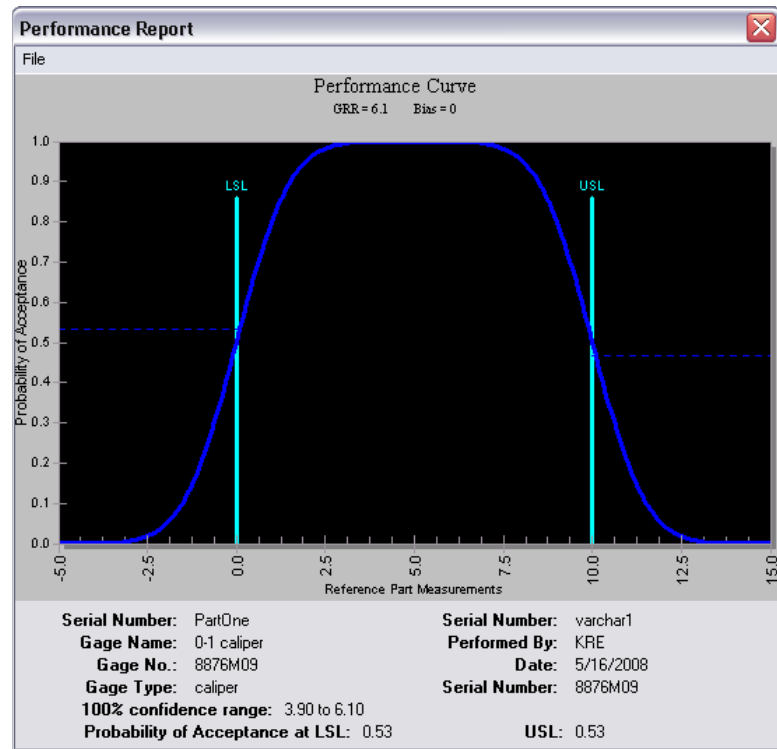
The preview window for short attribute GR&R studies looks like this:

Gage Repeatability and Reproducibility Report					
File					
Part No. & Name:		Gage Name: alt gage		Date: 7/22/2008	
Characteristic:		Gage No.: 53334		Performed by: ALG	
Specifications:		Gage Type:		User Field 1:	
Appraiser 1:		Appraiser 2:		Status	Fail
Part	Appr #1 Trial #1	Appr #1 Trial #2	Appr #2 Trial #1	Appr #2 Trial #2	
1	G	NG	NG	G	
2	G	NG	NG	G	
3	G	G	G	G	
4	G	G	G	G	
5	G	G	G	G	
6	G	G	G	G	
7	NG	G	G	G	
8	NG	NG	NG	G	
9	G	G	G	G	
10	G	G	G	G	
11	G	G	G	G	
12	G	G	G	G	
13	G	G	G	G	
14	G	G	G	G	
15	G	G	G	G	
16	G	G	G	G	
17	G	G	G	G	
18	G	G	G	G	
19	NG	G	G	G	
20	NG	G	G	G	

In this short attribute study example, 20 samples are measured by two appraisers in two trials each. Samples are selected in order to include examples of passing samples and failing products. Passing products are represented on the report by “G” and failing samples in the list are represented by “NG”. For the gage to pass, all trials must be the same across each row. In the example above you can see entries on rows 1, 2, 7, 8, 19, and 20 are not the same, so this gage fails the R&R study. If all trials for each sample match, then the gage is deemed acceptable.

6.6 Gage R&R – Performance Report

The preview window for a performance report looks like this:



The purpose of a gage performance curve is to determine the probability of a measurement system either accepting or rejecting parts improperly using data from Long Variable and Attribute gage studies. This tab applies to long and short variable studies and long attribute studies.

Once the amount of gage error has been determined via a gage study, it is possible to calculate the probability of accepting a part of some reference value when using the gage. To accomplish this, the assumption is made that repeatability and reproducibility are normally distributed with some variance, s^2 .

The gage performance curve provides a graphical method of communicating how well the measurement system is discriminating good parts from bad parts as the measurements approach the decision points at the upper and lower specs.

The graph contains x- and y- axes. The x-axis along the bottom contains values as reflected by the measurement system. The y-axis relates to the percent confidence. Specification limits are shown as vertical lines intersecting the x-axis. Normal curve tails intersect these specs and represent confidence indicators. At the intersection of either spec you can read the corresponding left or right scale to see the confidence one has in the measuring system's result at that size. For instance, in the case above the gage being used needs to be replaced because at the lower specification limit (0.00) we can only be about 45% confident about making the right decision to accept or reject product. (worse than simply flipping a coin).

Discrimination required from the gaging system is a function of cost, of the gage itself, of the products being measured and improperly scrapped, and of the personnel time required to do the inspection.

6.7 Calibration Certificate

There is no preview for the Calibration Certificate.

Calculations used in the Calibration Certificate are:

Bias = Average minus Nominal

Meas U = Uncertainty of measurements = 2 times the standard deviation of measurements for the calibration point

Status

Nothing, some values for the calibration point are missing

Fail if Bias plus Total Uncertainty is greater than positive tolerance OR Bias minus Total Uncertainty is lower than negative tolerance.

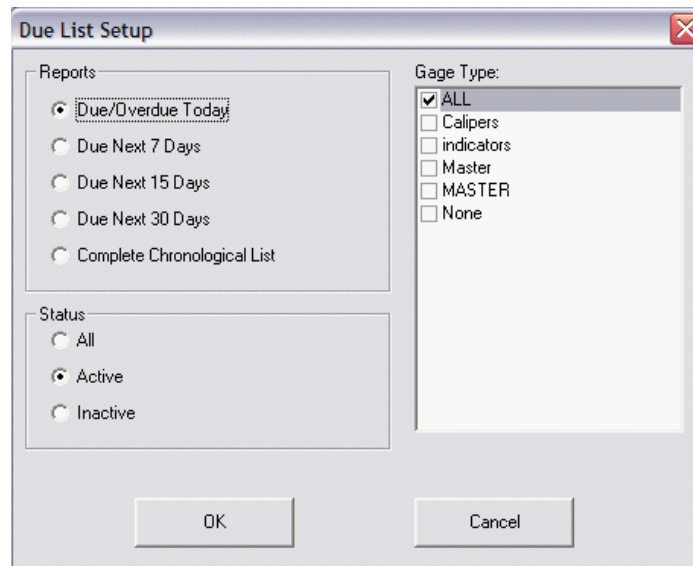
Pass if Bias plus Total Uncertainty is less than positive tolerance AND Bias minus Total Uncertainty is greater than negative tolerance.

Total Uncertainty = Square root of (Meas U squared plus Master U squared). If the Meas U or Master U column is not showing in the table, the relevant value is taken as zero.

Note: Status for the whole study is Fail if any calibration point in any calibration dataset is Fail. Status for the study is Pass if all calibration points in all calibration datasets are Pass. If data is incomplete and no calibration points are Fail then the status for the study is Not Set.

6.8 Calibration & GR&R Due

Select the desired report type (GAGE LISTS: CALIBRATION DUE, GR&R DUE, MASTER DUE) from the REPORTS menu. The “Due List Setup” window will appear.



Reports

In the “Reports” section, select a time frame for the report list.

Gage Status

In the “Status” section, select the status for gages to be included in the report. Status values are originally set or edited in the “gage description” window.

Gage Type

In the “Gage Type” list, select a gage type, if applicable. Gage Types are defined in setup and selected in the “gage description” window.

Cancel Button

Press the CANCEL button to close the “Due List Setup” window.

OK Button

After pressing the OK button, a list of gages due will appear. If no gages appear, none were found to be due under the conditions specified.

The list of gages due will look similar to this:

GR&R - GR&R Due ListComplete, Sorted Chronologically

File	Gage Number	Gage Type	Serial Number	Active Location	Storage Location	Due Date	Last Date	Active
1	0-1 caliper2	caliper	836787	Lab1	Storage2	6/20/2008	5/6/2008	Yes
2	alt gage	caliper	53334	Lab	Storage1	6/27/2008	5/28/2008	Yes
3	0-1 caliper	caliper	8876M09	Lab	Storage1	7/10/2008	6/10/2008	Yes
4	gage 1	Unknown Type	988547	Lab1	Storage2	New Gage	New Gage	Yes
5	gage1	Unknown Type	0977M17	Lab	Storage1	New Gage	New Gage	Yes
6	1-2 caliper	Unknown Type	14443222	Lab	Storage1	New Gage	New Gage	Yes

The gages in the list will appear in descending order based on the due date. Each gage listed will include the number/name, type, serial number, active and storage locations and active status as defined in the “gage description” window. The “last date” column shows the date a study was last performed for the gage. The number of days entered in the ‘re-evaluation intervals’ fields in the “gage description” window are added to the “last date” to determine the “due date” for the next study. Print the list by using the PRINT option in the FILE menu.

To copy from this preview window, highlight the desired cells and press [Ctrl]+[C] on the keyboard and then press [Ctrl]+[V] to paste into a spreadsheet or other document.

6.9 GR&R and Calibration Histories

The following procedure is used for printing GR&R and Calibration History reports.

Select the desired report type (GR&R HISTORY, CALIBRATION HISTORY) from the REPORTS menu. The “Gage catalog” window will then appear; select the desired gage from the gage catalog.

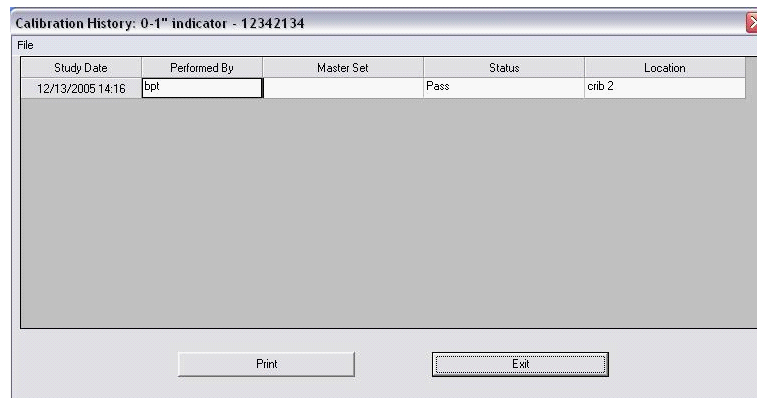
After you select a gage, the study “history” window will appear containing all studies performed for the report type selected. The studies will be sorted by date and time with the most recent on top. (If no studies exist in the list, no studies have been performed for this gage.)

The “history” window will look similar to one of these:

GR&R History

File	Study Date	Type	Performed By	Part	Characteristic	EV	AV	TV	Method
	5/29/2008 13:22	Actual Gage	TOL	PartOne	varchar1	1	0	94.71	ANOVA
	5/28/2008 15:41	Actual Gage				1	0	95.73	Long
	5/28/2008 15:13	Actual Gage		widget2000	weight	1	0	81.64	Long
	5/16/2008 11:54	Actual Gage	KRE	PartOne	varchar1	1	0	97.30	Long
	5/16/2008 10:59	Actual Gage	TOL			1	0	12.13	Long
	5/16/2008 10:31	Actual Gage	PVM	widget	thickness	0.970	0.000	96.84	Long
	5/14/2008 15:09	Actual Gage	KRE	widget2	length	0.000	0.350	34.89	Short
	5/14/2008 14:53	Actual Gage	KRE	widget2	length	0.9500	0.0000	95.07	ANOVA
	5/6/2008 11:21	Actual Gage	MTL	widget	width	0.92	0.00	91.71	Long

Print Exit



The spreadsheet areas of these windows are described in Chapter 4 – Data.

Print the history report using the PRINT button or FILE, PRINT menu item. Close the history window by using the EXIT button or FILE, EXIT menu item.

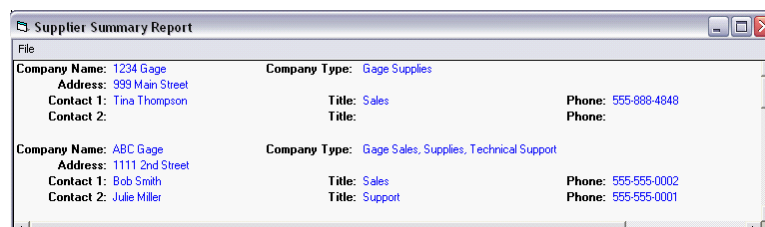
To copy from this preview window, highlight the desired cells and press [Ctrl]+[C] on the keyboard and then press [Ctrl]+[V] to paste into a spreadsheet or other document.

6.10 Supplier Summary

A supplier summary report is a list of all suppliers in the database along with attending information. The following procedure is used for printing a supplier summary report.

Select the SUPPLIER SUMMARY item from the REPORTS menu. A scrollable preview report will be displayed.

It will look similar to this:



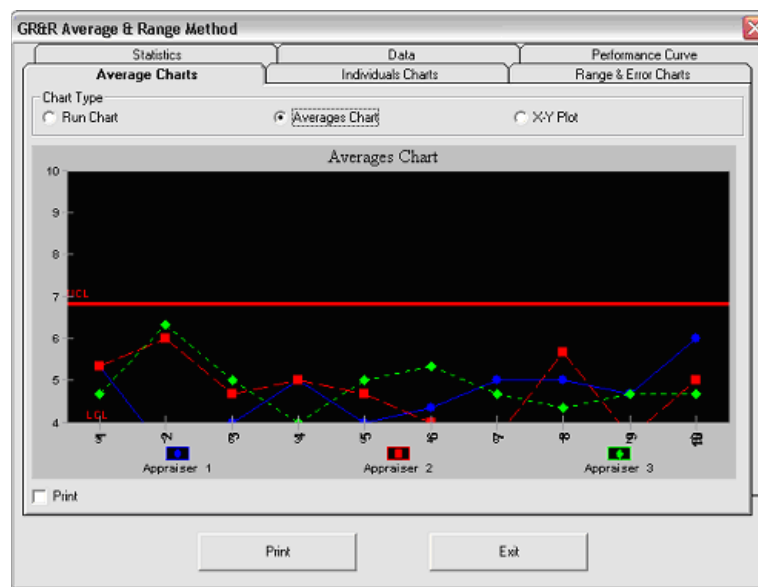
The suppliers will be sorted alphanumerically. Print or exit the report using the options in the FILE menu.

6.11 Additional Reports

Several additional reports are available via the analyze menu in the Gage R&R Study windows (under the main program window's data menu). Most of these graphical tools relate to long variable and ANOVA studies with the exception of the performance curve which also applies to long attribute studies.

These facilities are not available from the reports menu but are informational/reporting type resources, so we have referenced them here. These analyses are intended to provide different views of data and calculations to reveal measurement problems more clearly.

The following graphic example shows one of the analyses available along with the tabs to access others. The "print" checkbox on each tab allows you to select that analysis for inclusion on the report.



Part

VII

7 Setup - (Setup Menu)

7.1 System Definitions

The SYSTEM DEFINITIONS item brings up a window that contains three different tabs. All three tabs use the following buttons:

Save & Exit Button

The SAVE & EXIT button saves the information and closes the “System Definitions” window.

Exit Button

The EXIT button closes the “System Definitions” window.

Header Fields Tab

The “Header Fields” tab allows you to define up to 12 custom fields for use elsewhere in the program. They appear when creating gages, gage types, masters, and in certain reports.

The screenshot shows the 'System definitions' window with the 'Header Fields' tab selected. The window has a title bar with 'System definitions' and a close button. Below the title bar are four tabs: 'Identity', 'Reports', 'Header Fields' (which is active and highlighted), and 'File Viewers'. The 'Header Fields' tab contains a section titled 'Gage Description Headers' with a table of 12 user fields. The fields are arranged in two columns of six. Each field has a label (User Field #1 through User Field #12) and an adjacent text input box. At the bottom of the window are two buttons: 'Save & Exit' and 'Exit'.

Gage Description Headers			
User Field #1		User Field #3	
User Field #2		User Field #4	
User Field #3		User Field #5	
User Field #4		User Field #6	
User Field #5		User Field #7	
User Field #6		User Field #8	
User Field #7		User Field #9	
User Field #8		User Field #10	
User Field #9		User Field #11	
User Field #10		User Field #12	
User Field #11			
User Field #12			

In the “User Fields 1-12”, enter a field label. Examples of field names may include such items as “line”, “operation”, or “manager in charge”. You can create user fields 1-12 depending on your company’s specific needs.

Reports Tab

The “Reports” tab is used to set report preferences. You can add a logo, change report titles and include your company name to report titles.

Report	User Name	Instructions	Due Date	Signature line
GR&R AVERAGE & RANGE REPORT	GR&R AVERAGE & RANGE REPORT	☒ Include	☒ Include	☒ Include
GR&R ANOVA REPORT	GR&R ANOVA REPORT	☐ Include	☐ Include	☐ Include
GR&R ATTRIBUTE REPORT	GR&R ATTRIBUTE REPORT	☐ Include	☐ Include	☐ Include
GR&R BIAS REPORT	GR&R BIAS REPORT	☐ Include	☐ Include	☐ Include
CALIBRATION HISTORY REPORT	CALIBRATION HISTORY REPORT	☐ Include	☐ Include	☐ Include
Certificate Of Calibration	Certificate Of Calibration	☐ Include	☐ Include	☐ Include

Load Logo Button

To select a logo to be printed on your reports, press the LOAD LOGO button. A Windows® explorer window will then appear where you can browse and select your logo graphic file. You must then mark the “Include company logo on reports” checkbox for the logo to be printed. The logo graphic file path is visible in the field below the buttons. If a file path is visible in this field, a file is loaded for use in the reports. You cannot type in this field to change the path. It must be unloaded and reloaded to be changed.

Unload Button

To remove the logo that is currently loaded for use in the reports header, press the UNLOAD button.

View Logo Button

Use the VIEW LOGO button to view the logo graphic you selected. This feature will only be accessible if your logo has already been loaded.

Include Company Logo on Reports Checkbox

If you have loaded a logo graphic file, you must check the “Include company logo on reports” checkbox to print the logo on all supported reports. This feature will only be accessible if your logo has already been loaded.

Include Company Name on Reports Checkbox

If this check box is marked, the text entered in the “company name” field on the “Identity” tab will print as an additional title line at the top of each report. Checking this box will apply this feature to all supported reports.

Logo Width (mm)

You can resize the logo graphic for printing on the report by using the logo width field. Enter the desired width in millimeters (100 mm max.).

Report Titles Table

The report titles table contains two columns: “Report” column (default title) and “User Name” column. Use this area to re-title any of the available reports. To rename a report, click or double-click on the name you want to change in the “User Name” column and enter the desired title.

Identity Tab

Company Name

Originally, the “Company Name” field will contain the name of the company to which DataLyzer International, Inc. registered the software. The name in this field can be changed. Any changes made to the company name will flow backward to change the official registration (software’s owner of record). The entry in this field is the one used for printing in the reports, if desired (see Reports tab).

Note: In the event you wish to change the software’s official assignment that appears in the HELP, ABOUT DATALYZER window, please contact DataLyzer International, Inc.

File Viewers Tab

The screenshot shows a window titled "System definitions" with four tabs: "Identity", "Reports", "Header Fields", and "File Viewers". The "File Viewers" tab is selected. It contains three rows of text input fields, each with a "Change Folder" button to its right. The labels for the input fields are "Path to Microsoft Word Viewer", "Path to Microsoft Excel Viewer", and "Path to Microsoft PowerPoint Viewer:". At the bottom of the window, there are two buttons: "Save & Exit" and "Exit".

Change Folder

Use the buttons to locate the executable (.exe) files to use for viewing Microsoft Word documents, Excel spreadsheets and Power Point presentations.

7.2 Language

Use the LANGUAGE item to select the desired operating language for the program. The default language is English. The user-defined language item can be used to enter your own localized language. Contact DataLyzer International, Inc. for instructions regarding use of this option.

7.3 Preferences

The PREFERENCES item is used to set preferences for the various studies in the program.

Variable Study Preferences

You can set the preference configuration to match the variable Gage R&R study configuration you expect to use most frequently. These will come up as defaults when doing a new study or creating a GR&R Study Definition. They can also be changed at that time as necessary.

Type

Using the “Type” selection, choose whether the default GR&R variable study will be long or short.

Appraisers

Enter the default number of appraisers used when conducting a variable GR&R study in the “Appraisers” field.

Trials

Enter the default number of trails used when conducting a variable GR&R study in the “Trials” field.

Parts

Enter the default number of parts tested when conducting a variable GR&R study in the “Parts” field.

Attribute Study Preferences

You can set the preference configuration to match the attribute Gage R&R study configuration you expect to use most frequently in a similar way to a variable study.

Re-Evaluation Time Units

The re-evaluation period for Calibration studies and GR&R studies can be set in days or months. Set the Calibration re-evaluation period for a gage in the Gage Description window. Set the re-evaluation

period for GR&R studies when creating a GR&R Study Definition.

GR&R calculations based on

Traditionally the full spread of variation due to components measured during GR&R studies (EV, AV, R&R etc) was considered to be 5.15 times Sigma (Standard Deviation or Estimated Standard Deviation) of the component. 5.15 times standard deviation represents 99% if the full spread expected, assuming a “normal” distribution curve.

When 5.15 Sigma is selected in this frame, deviation values calculated from the study are multiplied by 5.15 for comparison with other sigma values or tolerance. When Process Variation if this is selected as the Total Variation method, the standard deviation of characteristic measurements is also multiplied by 5.15. When the Total Variation (TV) method is Tolerance, the study sigma values (after multiplication by 5.15) are compared with the total tolerance (USL-LSL).

6 times sigma represents 99.7% of the full spread of a “normal” curve. When 6 Sigma is selected in this frame, deviation values based on ANOVA calculations are multiplied by 6 before comparison with other sigma values. No multiplication factor is applied to values calculated from Average and Range. Because no multiplication factor is applied, when Tolerance is selected as the Total Variation method, the Tolerance value is divided by 6 : $(USL-LSL) / 6$.

Note that the AIAG MSA Manual shows calculations based on 5.15 Sigma in the first two editions. The Third Edition used 6 times Sigma for ANOVA and 1 times Sigma for Average and Range.

Alert if calibration or GR&R study is due in ... days

If this box is checked a message will appear when the program starts to warn if a calibration study or GR&R study is overdue or is due within the specified number of days.

Passing % Error Limit

Enter the passing percent error limit for Gage R&R studies in the “Passing % Error Limit” field.

Use Appraiser Names

When you mark the “Use Appraiser Name as Labels” checkbox, the DataLyzer Spectrum Gage Management software will use appraiser names rather than “appr #” in the labels for the data entry tables as well as on the reports.

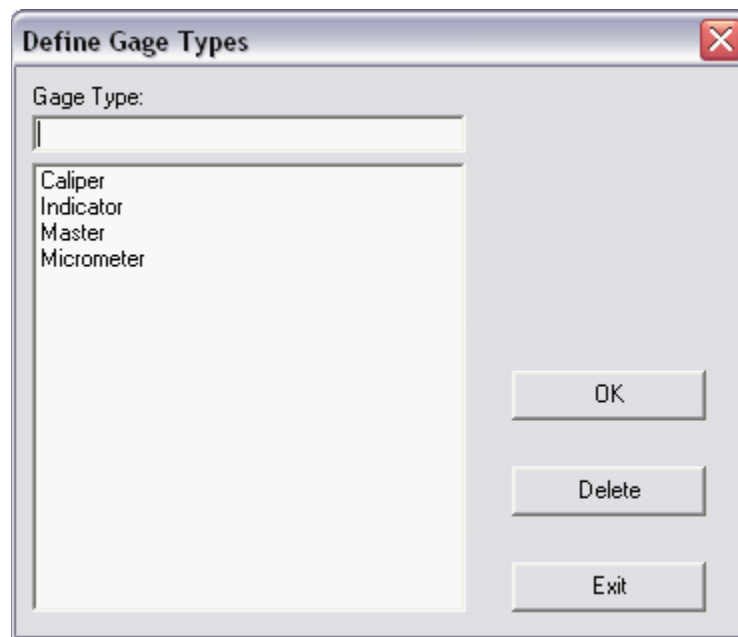
Include Atmospheric Information

When you check the “Include Atmospheric Information” checkbox, the “Calibration Study” window will include atmospheric fields such as temperature, humidity, and barometer.

7.4 Define Gage Types

The DataLyzer Spectrum Gage Management System allows gage types to be defined as a typing aid during gage creation. That means when you are creating a gage and declare it to be of a particular type, many fields are automatically filled-in from the information stored in the common gage type area. Beyond that, optionally, GR&R results from one gage can be applied to all gages of the same type; check with your auditor before establishing this procedure.

To create a gage type, select the DEFINE GAGE TYPES item from the SETUP menu. The following “Define Gage Types” catalog window will appear:



This window contains a catalog of all defined gage types. The “Master” gage type is automatically created in the software. Master type gages are used as masters to calibrate other gages. Masters typically do not undergo GR&R studies. Since they are highly precise they are usually more expensive than in-process type gaging and therefore inventorying them more frequently is wise management. Master gages are usually traceable back to an off-site measuring standard (i.e. a national or international standard unit of measurement).

To open an existing gage type, select it from the list or type its name in the “Gage Type” field. To create a new gage, enter the name of the new gage type in the “gage type” field.

OK Button

Press the OK button to open the “Gage Type Definition” window for the new or selected gage type.

Delete Button

To delete a gage type, select it from the list or type its name in the “Gage Type” field and press the DELETE button.

Exit Button

The EXIT button closes the “Define Gage Types” catalog and returns to the main DataLyzer Spectrum Gage Management software window.

“Gage Type Definition” Window

This section describes how a “Gage Type” is created. The “Gage Type” feature allows the user to

group or flag similar gages under one label or “gage type”. There is a twofold purpose:

1. It makes gage entries and studies easier to find in a large database
2. If allowed by your quality manual and auditors, gage R & R studies can be performed generalizing results from one gage to all gages in the associated gage type group.

To create or edit an existing gage type enter a new or existing gage type name and press OK in the “Define Gage Types” catalog, the “Gage Type Definition” window will appear. Any changes made in the gage type’s definition window after a gage type has been selected in other areas of the program will not be applied in those areas. The “Gage Type Definition” window looks like this:

Category

Use the “Variable” or “Attribute” option buttons to select whether the gage type is for variable or attribute (go/no-go) gages.

GRR Re-evaluation Interval (Days)

Enter the number of days between GR&R studies in the “GRR Re-evaluation Interval” field. This is often dictated by the organization’s quality manual or procedures.

Calibration Re-evaluation Interval (Days)

Enter the number of days between calibration studies in the “Calibration Re-evaluation Interval” field. This is often dictated by the organization’s quality manual or procedures.

Precision

Enter the smallest interval the gage can measure in the “Precision” field.

Range

Enter the range between the smallest and the largest sizes measurable by the gage in the “Range” field.

Manufacturer, #1 Gage Supplier, #2 Gage Supplier, #1 Supplies Company, #2 Supplies Company Buttons and Fields

No manual entry is allowed in the “Manufacturer”, “#1 Gage Supplier”, “#2 Gage Supplier”, “#1

Supplies Company”, or “#2 Supplies Company” fields. For entry in these fields, use the associated buttons to open the “Suppliers” list to select or create a gage supplier. Note that the applicable option button (e.g. manufacturer, gage supplies) is selected in this window, allowing only predefined suppliers of that type to appear for selection (however, if you create a new supplier, you can specify it to be any of the supplier types available in the system). To select a predefined supplier’s name from the list, double click it or highlight it in the list and press the SELECT button. Press CANCEL to exit without selecting a supplier. To create a new supplier, type a supplier name in the “Company” field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The “Gage Suppliers” setup window will then appear (see here for a description of this window).

Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Documentation #

The “Documentation #” field can be used to locate the manual or instructions for the gage

Battery Type

Enter the SKU or model number of the battery required by the gage (if any) in the “Battery Type” field.

Other Supplies

Enter any other supplies required to maintain or use the gage in the “Other Supplies” field.

User Fields 1-12

If custom user fields have been created in SETUP, SYSTEM DEFINITIONS, these fields will appear beneath the “Other Supplies” field. Enter the specified information as necessary.

GR&R and Calibration Menu

The INSTRUCTIONS menu item opens the Instructions window in Set mode. This is used to setup GR&R and Calibration study instructions for the gage type. When assigning the Gage Type to a Gage in the Gage Description window, the instructions for the Gage Type can be automatically applied.

File Menu - Save or [F2]

The SAVE item (or pressing [F2] without opening the menu) saves the changes made in the “Gage Type Definition” window.

File Menu - Save & Exit or [Ctrl]+[S]

The SAVE & EXIT item (or pressing [Ctrl]+[S] without opening the menu) saves the changes made to the gage type definition and exits to the “Define Gage Types” catalog window.

File Menu - Exit or [Ctrl]+[X]

The EXIT item (or pressing [Ctrl]+[X] without opening the menu) closes the gage type definition window without saving changes.

7.5 Define Masters

The DEFINE MASTERS item is provided to define master gage blocks for measuring and testing purposes. When conducting accuracy or calibration studies, gage measurements are compared with the “known” values of these standards to determine the accuracy of the gage.

Define Masters

File

Name/ID Number: MKR0020001 length ref

Serial Number: 2.5 mm - 25mm

Manufacturer: Mitutoyo Belgium NV

Calibration: Calimet

Recalibration Interval: 3650 Days

Date of Purchase: 11/09/1992 Cost: 280.00

Status:

Location:

Documentation #:

Supplies Company:

Other Supplies:

Notes: Set bestaat uit volgende lengtes:
2.5mm = 890791
5.1mm = 890204
7.7mm = 900051

Last Calibration Date: 27/09/2005 09 * current

Name/ID Number

The “Name/ID” field is automatically filled-in with the name entered in the previous “Gage Catalog” window. The name can be edited or changed.

Serial Number

In the “Serial Number” field, enter the serial number of the master, if it exists, for traceability purposes.

Manufacturer Button and Field

No manual entry is allowed in the “Manufacturer” field. For entry in this field, use the

MANUFACTURER button to open the "Suppliers" list to select or create a manufacturer. Note that the "manufacturer" option button is selected in this window, allowing predefined suppliers to be selected from a list. To select a manufacturer from the list, double click it or highlight it in the list and press the SELECT button. Press CANCEL to exit without selecting a supplier. To add a new manufacturer to the master list, type a supplier name in the "Company" field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The "Gage Suppliers" setup window will then appear (see here for a description of this window).

Once a supplier (manufacturer) is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Calibration Button and Field

No manual entry is allowed in the "Calibration" field. For entry in this field, use the CALIBRATION button to open the "Suppliers" list. Note that the "gage calibration" option button is selected in this window, allowing only predefined suppliers of that type to appear in the list for selection. To select a predefined supplier's name from the list, double click on it or highlight it in the list and press the SELECT. Press CANCEL to exit without selecting a supplier. To add a new supplier to the master list, type a supplier name in the "Company" field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The "Gage Suppliers" setup window will then appear (see here for a description of this window).

Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Recalibration Interval

Enter the number of days between calibrations in the "Recalibration Interval" field. This is often dictated by the organization's quality manual or procedures.

Date of Purchase

Enter the date the master was purchased in the "Date of Purchase" field.

Cost

Enter the cost of the master in the "Cost" field.

Status

Set the current status of the master by clicking on the Status button and selecting from the list. No manual entry is allowed, you must pick from the list.

Location

Set the current status of the master by clicking on the Location button and selecting from the list. You can also type in a location that is not in the list

Documentation #

Enter for the location of the documentation or the documentation ID for the master in the "Documentation #" field.

Supplies Company Button

No manual entry is allowed in the “Supplies Company” field. For entry in this field, use the SUPPLIES COMPANY button to open the “Suppliers” list to select or create a supplier. Note that the “gage supplies” option button is selected in this window, allowing only predefined suppliers of that type to appear in the list for selection (however, if you create a new supplier, you can specify them to be any of the supplier types available in the system). To add a new manufacturer to the master list, type a supplier name in the “Company” field and press SELECT. The program will notify you that the supplier does not exist and ask if you want to create it. Press YES. The “Gage Suppliers” setup window will then appear (see here for a description of this window).

Once a supplier is selected, it appears in the field. You can view more specific information about the supplier by clicking on the field; a window containing read-only information about the supplier will appear.

Other Supplies

Enter information about other supplies required that are specific to this master or master set in the “Other Supplies” field.

Notes

Enter any further notes documenting this master or master set in the “Notes” field.

Last Calibration Date

Enter the last calibration date for the master in the “Last Calibration Date” field.

User Fields 1-12

If custom user fields have been created in SETUP, SYSTEM DEFINITIONS, these fields will appear beneath the “Last Calibration Date” field. Enter the specified information as necessary.

File Menu – Save or [F2]

The SAVE item (or pressing [F2] without opening the menu) saves the changes made to the master.

File Menu - Save & Exit or [Ctrl]+[S]

The SAVE & EXIT item (or pressing [Ctrl]+[S] without opening the menu) saves the changes made to the master and returns to the main DataLyzer Spectrum Gage Management software window.

File Menu - Exit or [Ctrl]+[X]

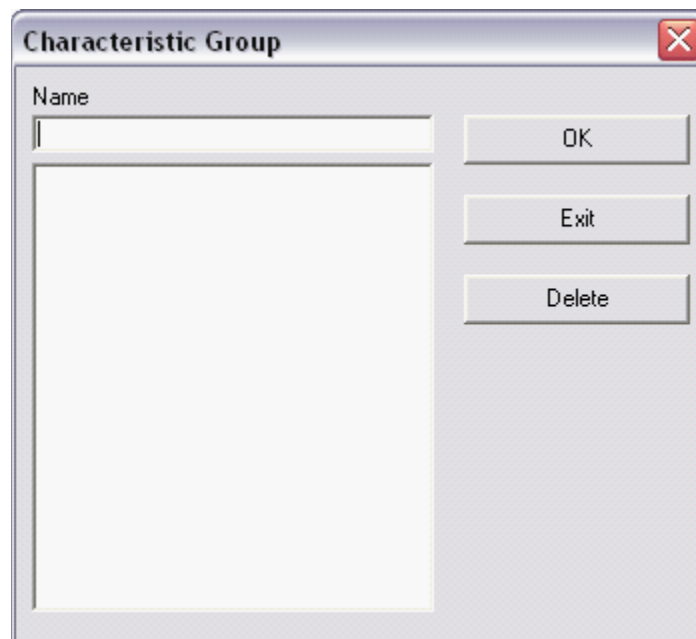
The EXIT item (or pressing [Ctrl]+[X] without opening the menu) closes the “Define Masters” window and exits to the main DataLyzer Spectrum Gage Management software window without saving.

7.6 Define GR&R Characteristic Groups

If you are using both the DataLyzer Spectrum Gage Management System and DataLyzer Spectrum SPC software, the DEFINE GR&R CHARACTERISTIC GROUPS facility is used allows you to search the shared database for characteristics with matching engineering specifications and methods of being measured. These characteristics can then be grouped together so that the results from studying one of these characteristics will be applied to all characteristics in the group. This type of group application is usually only done when a quality department is relatively small so that the same study appraisers would be involved in all GR&R studies anyway. It is not recommended where the number of appraisers involved exceeds three.

To use this facility, your DataLyzer Spectrum Gage Management System and DataLyzer Spectrum SPC software must share a database. This allows the Gage Management system to read the SPC characteristic information and search for matching characteristic criteria (specifications etc.). The 'database path' can be checked in both programs by going to HELP, ABOUT DATALYZER.

After selecting the DEFINE GR&R CHARACTERISTIC GROUPS item, the following window will appear:



Name field

To create a new characteristic group, type the name of the new group in the "Name" field. To open an existing characteristic group, select it from the list or type its name in the "Name" field.

OK button

The OK opens the "Characteristic Group" window for the new or selected characteristic group.

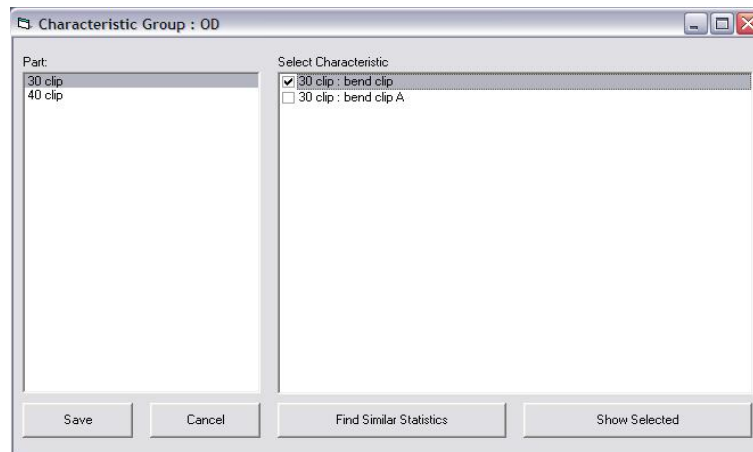
Exit Button

The EXIT button closes the window.

Delete Button

To delete an existing characteristic group, select a name from the list or type its name in the “Name” field and press the DELETE button.

Characteristic Group Window



Part List

The “Part” list, located in the left-hand side of the window lists all parts in the shared DataLyzer database. Select the part or parts whose characteristics you wish to group by double-clicking on the part or highlighting it and pressing enter.

Select Characteristic

Once a part is selected, all of its characteristics appear in the “Select Characteristic” list on the right-hand side of the screen. Select the characteristics you wish to group together by marking their checkboxes.

Save Button

The SAVE button saves the characteristic group.

Cancel Button

The CANCEL button closes the “Characteristic Group” window without saving changes.

Find Similar Characteristics Button

The FIND SIMILAR CHARACTERISTICS button will search all parts in the database for characteristics similar to the selected characteristics (at least one characteristic must be selected/checked for this button to work). All applicable characteristics will appear in the “Select Characteristic” list.

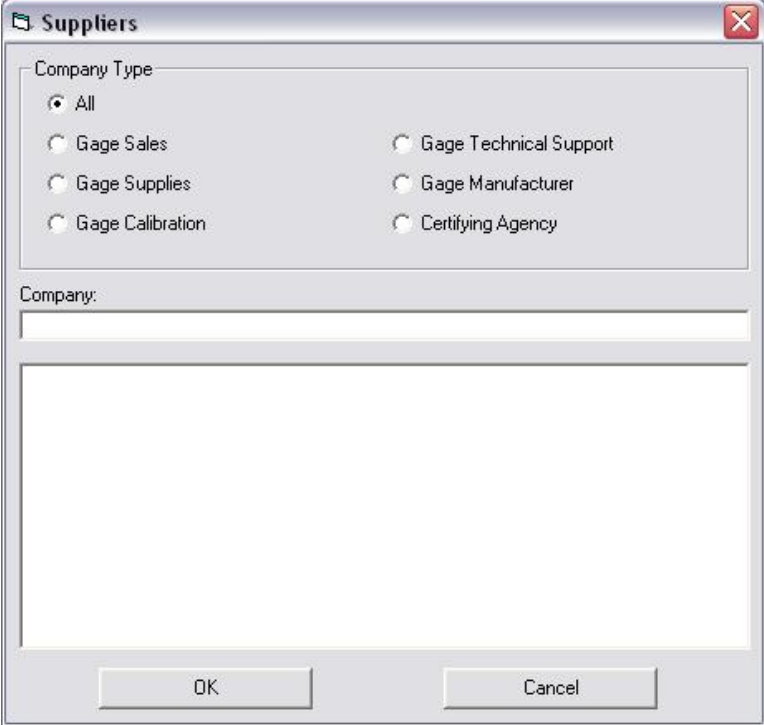
Show Selected

Pressing the SHOW SELECTED button hides all characteristics that are not selected as part of the

characteristic group.

7.7 Suppliers - New, Open & Delete

The NEW SUPPLIER, OPEN SUPPLIER, and DELETE SUPPLIER items use nearly identical windows to operate. After selecting one of these options from the SETUP menu, the following window will appear:

The image shows a Windows-style dialog box titled "Suppliers". It has a standard title bar with a minimize button, a maximize button, and a close button (a red square with a white 'X'). The dialog box is divided into two main sections. The top section is labeled "Company Type" and contains seven radio button options arranged in two columns. The first column has "All" (which is selected), "Gage Sales", "Gage Supplies", and "Gage Calibration". The second column has "Gage Technical Support", "Gage Manufacturer", and "Certifying Agency". Below this section is a label "Company:" followed by a single-line text input field. Underneath the text field is a large, empty rectangular area, likely intended for a list of suppliers. At the bottom of the dialog box are two buttons: "OK" on the left and "Cancel" on the right.

Company Type

Use the "Company Type" option buttons to select a supplier type. If you select a type other than "all", when creating a new supplier, this will carry through to the "Gage Suppliers" setup window. The option buttons determine what types of existing suppliers are contained in the list below the "Company" field.

Company

Enter the new or existing supplier name in the "Company" field. Existing suppliers will appear in a list below this field. To open or delete an existing supplier, you can type in the name or select it from the list.

OK Button

Press the OK button to open the "Gage Suppliers" setup window for the supplier name entered in the "Company" field.

Cancel Button

The CANCEL button closes the “Suppliers” catalog and returns to the main DataLyzer Spectrum Gage Management software window.

7.8 Supplier Details

The following “Gage Suppliers” window is used to enter the details for a new supplier or edit existing supplier information.

The screenshot shows the 'Gage Suppliers' window with the following sections:

- File** (Menu)
- Company Information**
 - Name: NM Gages
 - Address: [Empty]
 - City: [Empty]
 - State: [Empty]
 - Zip Code: [Empty]
 - Country: [Empty]
 - Contact 1: [Empty]
 - Title: [Empty]
 - Phone: [Empty]
 - e-Mail: [Empty]
 - Contact 2: [Empty]
 - Title: [Empty]
 - Phone: [Empty]
 - e-Mail: [Empty]
 - Fax: [Empty]
 - Website: [Empty]
- Company Type**
 - ☐ Gage Sales
 - ☐ Gage Supplies
 - ☐ Gage Calibration
 - ☐ Gage Technical Support
 - ☐ Gage Manufacturer
 - ☐ Certifying Agency
- Certification**
 - Certifying Agency: [Empty]
 - Cert. #: [Empty]
 - Expiration Date: [Empty]
 - Document #: [Empty]
- Notes:** [Empty Text Area]
- Buttons:** Save, Exit

Company Information

Use the fields in the “Company Information” portion of the supplier window to enter general contact information for the supplier.

Company Type

If you selected a company type option button other than “all” in the previous “Suppliers” catalog when creating a new supplier, this company type will be selected here. However, you can select as many types that apply to the supplier being currently defined.

In certain areas of the program where the system accesses the "Suppliers" catalog, the catalog may contain only suppliers of a particular "company type" as determined by the software. Therefore, when creating or editing gage supplier information, it is important to remember to select all possible "company types" that may apply for each supplier so these suppliers can be accessed in the necessary lists.

The "Gage Sales" company type indicates the supplier being defined sells gages. "Gage Supplies" indicates the supplier being defined is a source for gage supplies (cleaners, solvents, tissues, chemicals, etc.). "Gage Calibration" indicates this company calibrates gages. "Gage Technical Support" signifies this company supplies technical support. "Gage Manufacturer" denotes this company manufactures gages. "Certifying Agency" indicates the supplier does gage certifications.

NOTE: If the supplier does certifications or calibrations, their standards should be traceable to a national or international standard. Use the fields in the "Certification" area of this window to specify the traceability information.

Certification

Use the fields in the "certification" area to enter traceability information for "Gage calibration" and "Certifying agency" company types.

Enter the agency that certified the supplier to do its certifications in the "Certifying Agency" field. Enter the certification number of the supplier authorizing it to do certifications in the "Cert. #" field. Enter the date of the certification's expiration in the "Expiration Date" field. The "Document #" field allows you to add internal traceability information.

Notes

Use the "Notes" field for any extra comments you wish to add about the supplier.

Save Button

The SAVE button saves the changes made to the supplier's information and exits the window. The SAVE button only appears when using the NEW SUPPLIER or OPEN SUPPLIER options.

Delete Button

The DELETE button will delete the currently displayed supplier. The DELETE button will only appear when using the DELETE SUPPLIER option.

Exit Button

The EXIT button closes the supplier window without saving changes or without deleting.

File Menu – Save or [F2]

To save the information in the "Gage Suppliers" setup window, select SAVE from the FILE menu or press [F2] without opening the menu.

File Menu - Save & Exit or [Ctrl]+[S]

When using the NEW SUPPLIER or OPEN SUPPLIER options, select FILE, SAVE & EXT (or press

[Ctrl]+[S] without opening the menu) to save the information and close the “Gage Suppliers” setup window. When using the DELETE SUPPLIER option, select FILE, SAVE & EXIT (or press [Ctrl]+[S] without opening the menu) to delete the currently displayed supplier.

File Menu – Print or [Ctrl]+[P]

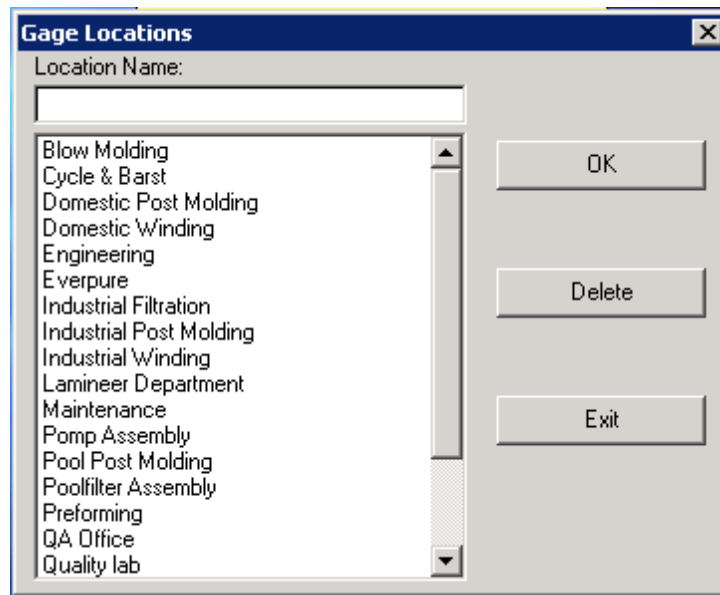
To print the information in the “Gage Suppliers” setup window, select PRINT from the FILE menu or press [Ctrl]+[P] without opening the menu.

File Menu - Exit or [Ctrl]+[X]

To close the “Gage Suppliers” setup window without saving, select EXIT from the FILE menu or press [Ctrl]+[X] without opening the menu.

7.9 Gage Locations

The GAGE LOCATIONS item allows you to set up a list of locations that you can expect gages to be found. Setting a location for a gage is done in the Gage Description window. The gage locations in the list are only suggested locations, it is not compulsory to choose a location from the list. When you select the GAGE LOCATIONS item, the following window will appear:



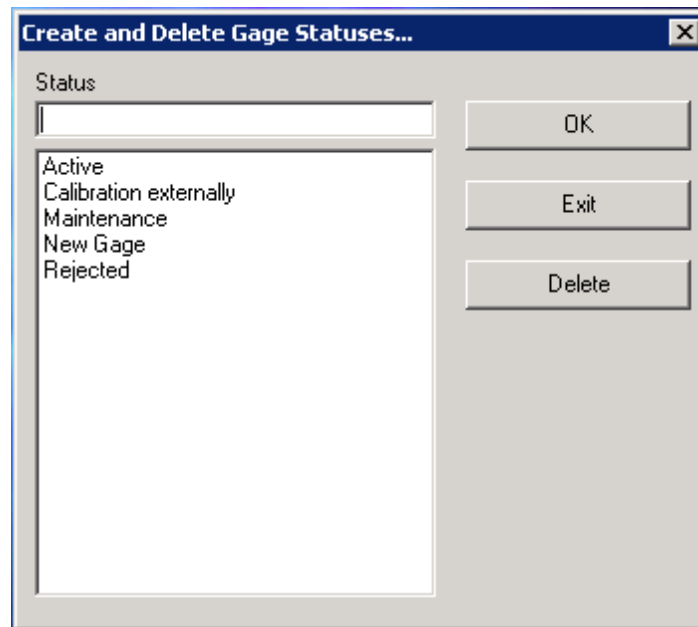
The OK button opens the selected gage location description window. The DELETE button deletes the selected gage location. The EXIT button closes the “Gage Locations” catalog window.

Location Name

Type the name of a new or existing storage location in the “Location Name” field, or select an existing location name from the list to open.

7.10 Gage Statuses and Inspectors

Choosing Gage Status or Inspectors from the Setup menu opens a window like this. With this window you can create a new Gage Status or Inspector or delete an existing one.



To create a new status or inspector, type in the name of the new status or inspector and click the OK button.

To delete a Status or Inspector click on the name in the list then click the DELETE button.

The EXIT button closes the window.

7.11 Gage Interface Template

Gage interface templates, or gage drivers, are created to allow direct communication between the gage or gage interface and the DataLyzer Spectrum Gage Management software. They provide specific information about the gage to ensure proper communication with DataLyzer Spectrum Gage Management software. The template supports RS-232 communication for up to four com ports: com 1 and 2 along with two virtual com ports for extended serial communication. Gage interface templates for the most commonly used gages and interfaces are provided with the DataLyzer Spectrum Gage Management software. Other gage drivers can be created allowing the DataLyzer Spectrum Gage Management software to operate with your specific gages. Once a gage driver is setup, it can be used in the "Com Port Assignment" window.

The information in this section describes the process of defining a gage driver that can then be used by the DataLyzer Spectrum Gage Management software to control any of the computer's four com ports.

Gage drivers do two things: they define the RS-232 communication environment in terms of baud rate, parity, stop bits, etc., and they tell the DataLyzer Spectrum Gage Management package the actual location of the measurement within the gage's transmission. The transmitted string may contain information such as: a measurement value, +/- sign, units of measure, serial number of device, date and time stamp, etc. The order and contents of the transmitted string is different for each instrument or interface. The purpose of the template is to define a mask to lay over the transmitted string of characters, so that each time a string is received, the mask can pick out only a specific set of characters (the measurement) from the string. Maybe the measurement number is located in the 5th through the 12th space in the string of transmitted characters. That is where this gage driver's template should be set to pick up valid values for data entry.

Steps for gage driver creation and use:

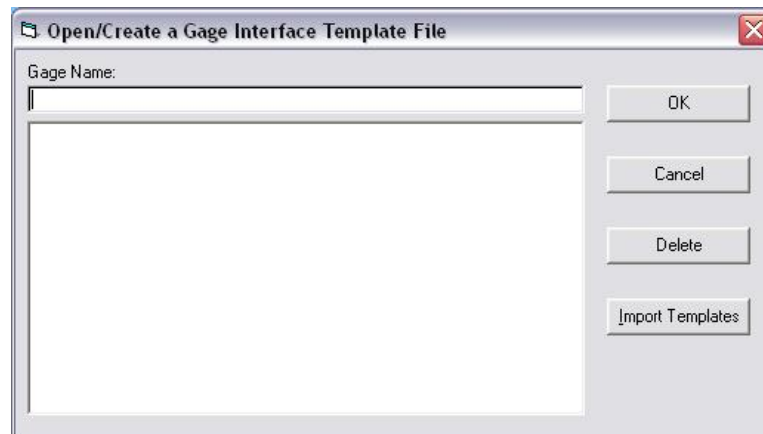
1. Configure the communication parameters to match the gage transmissions. This means the software's baud rate, parity, data bits, and stop bits must all match the gage's settings. Refer to the instrument's user's manual for this information.
2. Enter any necessary commands that prompt the gage for readings, define line termination characters and the number of lines to be transmitted in the string.
3. Take a test transmission from the gage to verify communication and define the string template or mask mentioned earlier.
4. Once the driver is created, you must assign it permanently to the com port where the instrument is connected. Com port assignments during template tests are temporary.

DataLyzer International, Inc. always recommends purchasing the RS-232 connecting cable directly from the gage or interface manufacturer to eliminate any cable problems. The RS-232 cable between the gage and the computer must be pinned correctly. If the individual conductors inside the RS-232 cable are not connected to the correct pins at each end, communication will be impossible and valuable time will be wasted during system implementation.

Note about USB communication support:

The DataLyzer system supports RS-232 communication for up to four com ports: com 1 and 2 along with two virtual com ports for extended serial communication. The virtual com ports are often used for supporting USB to RS-232 conversion cable systems where separate software is installed to make a USB port emulate a com port or for metaframe serial communication under systems like Citrix or Microsoft's Terminal Services. Gage interfaces that are already completely USB compatible require no RS-232 conversion and therefore do not require the use of the gage template system (e.g. Mitutoyo #264-012 USB single gage interface). In cases of USB-compatible interfaces, the gage assignments for the two virtual comports should be set to "no gage" because communication is automatically built into the operating system and these interfaces should begin working as soon as they are plugged in.

From the SETUP menu, select the GAGE INTERFACE TEMPLATE item. The following window will appear:



Enter a new gage name in the “Gage Name” field or select a gage file name from the list. Press OK to open the “Gage Template” window.

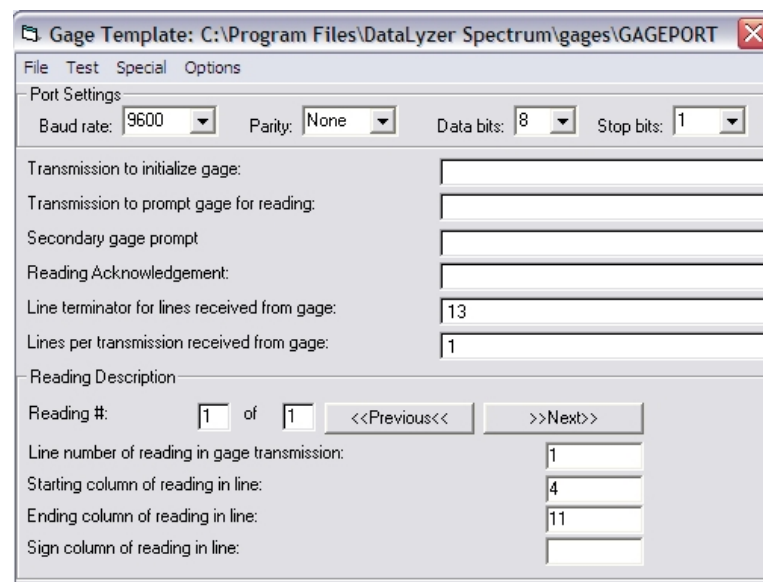
The CANCEL button closes the “Open/Create a Gage Interface Template File” window.

To delete a gage template, select the desired name from the list and click the DELETE button.

When you are sharing a database with the DataLyzer Spectrum SPC package, an IMPORT TEMPLATES button is available. Use it to import existing gage driver files that exist in the database.

7.12 Gage Template Window

The "Gage Template" window looks like this:



Port Settings

Refer to the user's manual of your RS-232 gage or multiplexing interface for information regarding its baud rate, parity, data bits, and stop bits. Set the "port settings" fields to match. Defaults are: 9600 baud, no parity, eight data bits, one stop bit.

Ordinarily, gage communication works on a "push" system where a transmit button is pressed and the gage sends a measurement, however, as DataLyzer products have matured, features have been developed to handle certain specific situations.

Transmission to Initialize Gage

The "transmission to initialize gage" field is only used when a gage interface requires a particular set of characters to "wake it up" or when the gage must receive a specific command to set it into a mode for sending data. This transmission from the computer to the gage is typically only required once per session. Refer to the gage manufacturer's operating manual and enter the necessary set of characters in this field. If the gage requires no initialization message, leave this field blank.

You can use ASCII characters or literals as entries for this field. When using ASCII characters, enter the associated ASCII number, separated by commas, for any characters such as carriage return and line feed (e.g. 13, 10) that do not display when typed. When using literals, enclose them in quotation marks (e.g. "SEND"). 'P' is a special character when used outside quotation marks that indicates a one-second pause. It can be used between commands sent to the gage to allow the gage enough time to process each command.

Transmission to Prompt Gage for Reading

The "transmission to prompt gage for reading" field is used only when a gage interface requires a particular set of characters to be transmitted to it before it will transmit each measurement. Enter the necessary set of characters in this field. When a gage driver is assigned that contains a "transmission to prompt gage for reading", during data entry a small button will appear in the data entry window. This button will contain a label of "Gage1", "Gage 2", etc. These labels correspond to the com port to which the associated gage driver is assigned. Press the screen button to cause a measurement to be transmitted by the gage.

You can use ASCII characters or literals as entries for this field. When using ASCII characters, enter the associated ASCII number, separated by commas, for any characters such as carriage return and line feed (e.g. 13, 10) that do not display when typed. When using literals, enclose the word in quotation marks (e.g. "SEND"). 'P' is a special character that, when used outside quotation marks, indicates a one-second pause. It can be used between commands sent to the gage to allow the gage enough time to process each command.

Secondary Gage Prompt

Sometimes instruments require a prompt to be sent causing them to take readings into their memory, then another prompt to transmit those measurements from memory to the computer. As one example, the GagePort's "computer mode" works in this manner. Enter into this field the secondary prompt required by the gage for it to send from memory. As in previous cases, ASCII characters and literals are supported.

Reading Acknowledgment

Sometimes instruments require the computer to return a 'got it' message, confirming its measurement was received before additional data can be collected. When this is true, put the string expected by the instrument in the acknowledgment field. As in previous cases, ASCII characters and literals are supported.

Line Terminator for Lines Received by the Gage

The software must be told what character or set of characters will be at the end of each line sent by the gage. The "line terminator for lines received by the gage" field is used to enter the line terminator character(s). In most cases, entries for this field will not be visible when typed, such as carriage return and line feed. The default is carriage return (ASCII character 13).

When more than one entry is made in this field, thereby establishing more than one character for line termination, commas should be used between the characters. If the comma itself is a line terminator, use the ASCII character 44 for the comma character.

Using a line terminator is the most commonly used technique, however, there is an alternative that can be used in certain situations, which is using fixed line length (described later).

Lines Per Transmission Received from The Gage

The "lines per transmission received from the gage" field is used to enter the number of lines the gage will send each time it transmits. See the gage's operating manual for this information. This feature relates to the previously described line terminator item. Remember that the default line termination character is carriage return.

If it is not clear exactly how many lines are transmitted, it may be necessary to use the CREATE TEMPLATE item in the TEST menu to take test transmission(s) that displays the number of lines being transmitted. To do this, set the number of lines to a large number such as "8" or "10" and read the gage. You'll be able to see five lines at a time. By taking a test string and waiting for timeout, the software will report how many lines were received from the gage (the maximum being the number of lines set in this field). A field will appear next to the word "transmission" that will report how many actual lines were received from the gage; then you can go back and adjust the number of lines per transmission accordingly. Save the template, and then enter the actual number of lines received in the gage template window.

Once you have set the lines per transmission correctly, you may proceed defining the template with the "#" signs (see the following "Reading Description" fields).

Reading Description Fields

Values for this area must be set through the CREATE TEMPLATE facility in the TEST menu. Entries are visible from this screen for summary purposes only and cannot be changed using the keyboard.

Reading # Field

In some cases a gage will transmit multiple measurements at one time. These fields indicate which measurement is being referenced by the measurement locator fields (starting, ending, and sign columns). These will be described later in detail. Refer also to the "Test Menu, Create Template" area for setting up a template to handle multiple readings per line. Up to eight readings can be identified and used from one transmitted line.

Previous and Next Buttons

When a multiple reading template is being used, the PREVIOUS and NEXT buttons allow movement between reading locations. When these buttons are used, you will note the “reading number # of #” fields will change along the measurement locator fields to indicate which reading you are on and where within the string that reading is located. A maximum of 64 individual measurements can be identified and used from each transmission.

Line Number of the Reading in the Gage Transmission

The “line number of the reading in the gage transmission” field is set from the “Test–Create Template” area. When multiple lines are transmitted from the gage, this feature allows you to tell the software which line will contain the measurement you want. After setting this information in the “Test–Create Template” window, it will flow through to be set in the gage template window as well.

Starting Column of Reading in the Line

The “starting column of reading in the line” field is set from the “Test–Create Template” area. Its purpose is to locate the position of the first character in the transmission’s actual measurement value. No measuring units, channel identifiers, or other textual information in the transmission should be confused with the location of the first character in the measurement. This first character of a measurement is often a + or - sign and these should be included in the set of #### when creating the template in the test area.

Ending Column of Reading in the Line

The “ending column of the reading in the line” field is set from the “Test–Create Template” area. Its purpose is to locate the position of the last character of the transmission’s actual measurement value. No measuring units, channel identifiers, or other miscellaneous information in the transmission should be confused with the location of the last character in the measurement.

Sign Column of Reading in Line

The “sign column of reading in line” is the location of the measurement’s sign (+/-) in the transmission. ” This field is set from the “Test–Create Template” area. This facility is only used when the sign of the measurement is not contiguous with (right next to) the measurement. Also, it is also not necessary if the measurements to be received will always be positive.

7.12.1 File Menu

New

Use the NEW item from the FILE menu or [CTRL]+[N] from outside the menu to create a new gage driver.

Open

Use the OPEN item from the FILE menu or [CTRL]+[O] from outside the menu to open an existing gage driver.

Save

Use the SAVE item from the FILE menu or [CTRL]+[S] from outside the menu to save the current gage driver. You must always save a template before you can use it to control the computer’s RS-

232 com port(s).

Save As

Use the SAVE AS item from the FILE menu to save the selected gage driver with the name you have supplied.

Print

Use the PRINT item from the FILE menu to print the current gage driver's settings.

Exit

Use the EXIT item from the FILE menu to exit without saving.

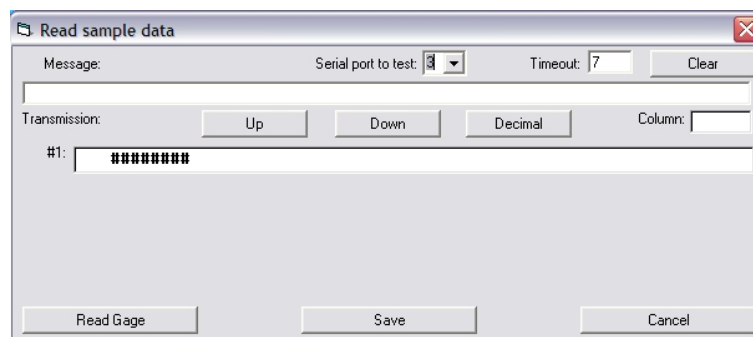
7.12.2 Test Menu

Create Template

The CREATE TEMPLATE item allows data acquisition from a com port using the baud rate, parity and stop bit settings of the selected gage template/driver. This testing process is also used to set the "reading description" fields of the "Gage Template" template window.

Once communication parameters are set in the "Gage Template" window, the interface is tested using the "Create Template" window. If the parameters are set correctly and if the RS-232 cable pinouts are correct, you should be able to receive a string of characters from the instrument. When you click READ GAGE a seven-second countdown starts, giving you time to press the button on your instrument ("send" or "print" or "transmit") that causes it to transmit a string of characters to the computer. This string appears in the (transmission line) "#1" field. You will be asked to overwrite the measurement number in the string with pound signs (#) to make a mask or template for future transmissions from this instrument. Save the template and exit.

The "Create Template" window looks like this:



Serial Port to Test

Use the "serial port to test" area to temporarily designate a com port to use for the current test. This selection will not be stored permanently, because the com port selection for ongoing use is made from the COM PORT ASSIGNMENTS item in the SETUP menu.

Timeout

Use the "Timeout" field to enter the number of seconds the template will wait for an RS-232 string from the instrument.

Clear Button

The CLEAR button clears all transmission lines of previously set '#'s and extraneous characters that may exist from previous tests.

Message

The "Message" field will display operational comments that the software reports about the transmission. Messages include: opening com port, send data now, communication timeout, etc.

Transmission Field(s)

The number of transmission fields displayed in the "Transmission" area is determined by the number entered in the "lines per transmission received from gage" field in the "Gage Template" window. These fields are used to define the template that is used to mask and pull out measurement values from the string. When a gage transmits one or more strings of information during testing, they will appear in these fields.

Use the arrow keys to access only the lines and columns that have characters received from the gage (including spaces). Then overwrite the desired measurement number (including the decimal point) in each line with pound signs (#) and save the template. Thereafter during standard use, each time the gage transmits a string of characters, the software will pick up values located under the positions designated by '#'s in the template they form and use these values as numeric input for data entry. A maximum of 130 characters can be accommodated on each transmission line.

When the (+/-) sign of the measurement value in the transmitted string is right in front of the measurement (i.e. they are contiguous), overwrite the sign with a '#' also. When they are not contiguous, overwrite the sign with an 'S' (for sign).

Once created, use the TEST TEMPLATE item in the TEST menu so as not to disturb the template '#' signs. If the '#' sign template placement is incorrect, you will only get part of the measurement value through to the software during data entry. A gage reading like 3.655 might come through as 655.

The Up and Down Buttons

The UP and DOWN buttons allow you to scroll to the transmission lines that are off the screen.

The Decimal Button

Pressing the DECIMAL button after you take a sample string from a gage will cause each character in every line to be replaced with its ASCII decimal equivalent. The ASCII values will be in square brackets. This function allows you to see unprintable characters that may be in the transmission.

Example:

```
1234567890
Gage transmission:  X: 5.42mm
```

After pressing DECIMAL: [10] [88] [58] [32] [53] [46] [52] [50] [109] [109]

Column

The “column” field shows the position of the cursor within the “transmission” field.

Advanced Concept–Multiple Measurement Values per Transmitted Line

Some instruments transmit more than one measurement in a line. To accommodate these situations without sending the same string twice, overwrite each character in the measurement (including the decimal point) with ‘#’s and save the template. At least one space should exist between the measurements to separate them. When a (+/-) sign is found right in front of the measurement (i.e. contiguous), overwrite the sign with a ‘#’. When the (+/-) sign is not contiguous overwrite the sign with ‘#’ and add enough ‘#’s to the string to connect it with the measurement.

Once created, use the TEST TEMPLATE item in the TEST menu so as not to disturb the template ‘#’ signs. If the ‘#’ sign template placement is incorrect, you will only get part of the measurement value through to the software during data entry. A gage reading like 3.655 might come through as 655.

There is a maximum of eight unique measurement values that the software can process per line. There is also a maximum of 64 values that can be processed for all lines of a full transmission. So, an eight-line transmission could have a total of eight accessible measurements per line. Most of the standard interfaces used, transmit only one measurement per line.

The Read Gage Button

The READ GAGE button is used to set the software to receive a transmitted string. It will open the designated com-port and continue trying to receive a string from the gage for seven seconds (by default), after which a “time out error” will be reported in the message field. This waiting interval can be changed through the COMMUNICATION item in the OPTIONS menu.

Save Button

The SAVE button stores all the template information. If no further changes are made to the main gage template window, saving at the outer level would be redundant.

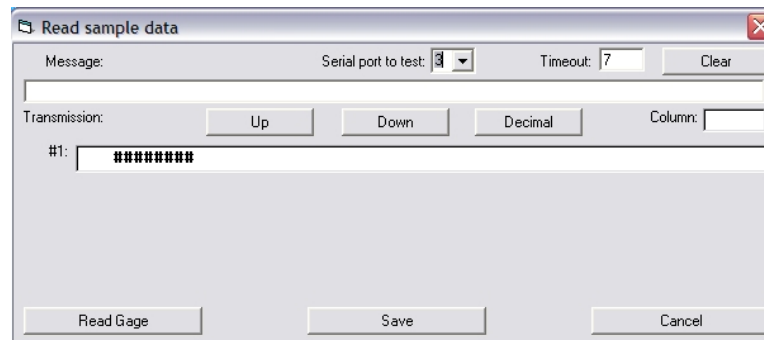
Cancel Button

The CANCEL button exits without storing anything.

Test Template

The TEST TEMPLATE item allows you to test the template filter(s) created in the “Create Template” window. If you test a template in the “Create Template” window, the test will overwrite the template (‘#’s and ‘S’ signs) and you will have to replace them after each test. The “Test Template” window not only confirms communications but also displays other information like the mode, reading, and channel identifiers as well as any analog to digital (A/D) conversions that are taking place.

The “Test Template” window looks like this:



Serial Port

Use the “serial port to test” area to temporarily designate a com port to use for the current test. This selection will not be stored permanently, because the com port selection for ongoing use is made from the COM PORT ASSIGNMENTS item in the SETUP menu.

Timeout

Use the “Timeout” field to enter the number of seconds the template will wait for an RS-232 string from the instrument.

Clear Button

The CLEAR button clears the test reading window.

Message

The “Message” field will display operational comments that the software reports about the transmission. Messages include: opening com port, send data now, communication timeout, etc.

Filtered Readings

This area displays characters transmitted from the gage. To use this window:

1. Set the com port to be used for this test using the option buttons.
2. Access the READ GAGE button. (A countdown will begin.)
3. Press the “transmit” or “print” button on your gage.

The current template will be used and attempt to receive data from the gage.

Messages such as “reading complete” or “time out error” may display in the message field.

If the software receives anything from the gage through the template, it will show up in the filtered readings area along with some additional comments supplied by the software related to the number of channels received, the line number and item number in the line associated with each measurement, etc. <<<??? Should have graphical eg>>>

Read Gage Button

The READ GAGE button attempts to take measurements from the gage for seven seconds, after which “time out error” will be reported in the message field.

OK Button

The OK button saves and exits one level to the gage setup window.

7.12.3 Special Menu

The SPECIAL menu allows selection of several types of special gaging situations. Once anything other than “standard” has been selected, the associated window will appear for additional settings in that area.

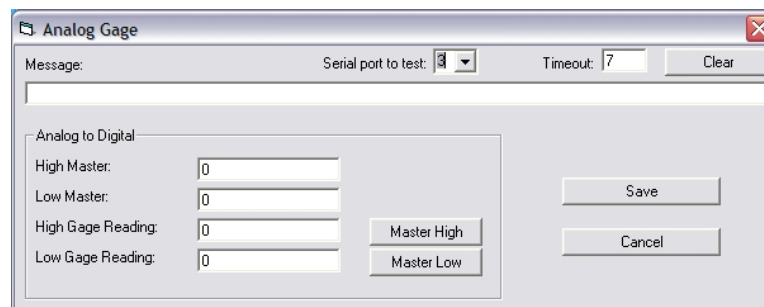
Standard

Unless the gage is one of the special types listed on this window, the standard item should be checked in this area.

Single Channel A/D (Analog to Digital)

This facility is used to master analog to digital transmissions. Typically A/D converters break an analog DC voltage range into digital segments. An example would be a 12-bit A/D converter breaking a given DC voltage range into 4096 digital segments. If the analog range is +2 volts DC to -2 volts DC, this 4-volt range will be divided into 4096 segments or approximately 1000th of a volt per segment. A/D interfaces typically transmit a measurement in terms of the number of segments the measurement represents out of the total voltage range. Therefore, if the gage can measure +.010 inches to -.010 inches, this range will be cut into 4096 segments with each segment approximately equal to .000005 of an inch. This means that each 1000th of a DC volt increment is represented by .000005 of an inch travel in the gage. Therefore, when the gage measures +.005 inches it will transmit the representative number of segments or 3000. This value is then converted into inches with the result reported to the software as the measurement from the gage, in this case +.005 inches. This process of interpolation can be setup automatically using the SINGLE CHANNEL A/D facility. It is sometimes referred to as mastering.

The window looks like this:



The screenshot shows a window titled "Analog Gage" with a standard Windows-style title bar (minimize, maximize, close buttons). Inside the window, there is a "Message:" label followed by a text area. To the right of the message area are two fields: "Serial port to test:" with a pull-down menu showing "3", and "Timeout:" with a text box containing "7". A "Clear" button is to the right of the timeout field. Below these fields is a section titled "Analog to Digital" which contains four input fields: "High Master:" (0), "Low Master:" (0), "High Gage Reading:" (0), and "Low Gage Reading:" (0). To the right of these fields are two buttons: "Master High" and "Master Low". Further to the right are two larger buttons: "Save" and "Cancel".

Serial Port to Test

The “Serial port to test” area includes a pull down list for specifying which RS-232 port will be used for testing.

Timeout

Use the “Timeout” field to enter the number of seconds the template will wait for an RS-232 string

from the instrument.

Clear Button

The CLEAR button clears the window.

Message

The "Message" field allows DataLyzer Spectrum Gage Management software to report messages about the transmission being received. Messages such as "reading complete" or "time out error" may display in this field.

Analog to Digital

The "Analog to Digital" area allows you to high and low master the gage and set the software to do an automatic interpolation.

Use a large and small master gage block or other standard for this test.

The procedure:

1. Enter the dimensional size of your high master in the high master field.
2. Enter the dimensional size of your low master in the low master field.
3. Position your cursor in the "high gage reading" field, then put your high master into the gage and transmit a value to the software using the MASTER HIGH button. The value will transmit from the gage in terms of a number of digital segments as discussed earlier and will display in the "high gage reading" field.
4. Position your cursor in the low gage reading field, then put your low master into the gage and transmit a value to the software using the MASTER LOW button. The value will transmit from the gage in terms of a number of digital segments as discussed earlier and will display in the "low gage reading" field.
5. Save the gage file template by using the SAVE button.

This sets up an automatic interpolation relationship. The software does the following calculation automatically:

$$[(\text{High master size})-(\text{Low master size})]/[(\text{High \# segments received})-(\text{Low \#segment received})]$$

This defines the "measurement size" corresponding to each digital segment received. The multiplication of the number of segments by the measurement increment per segment is then done automatically in the background so the actual measurement value is entered in the input window as the current measurement value.

Save Button

The SAVE button saves the template.

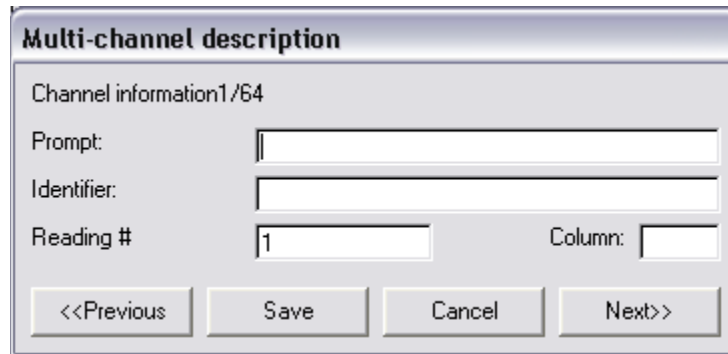
Cancel Button

The CANCEL button exits without saving.

Special Menu - Multi-Channel

Some gages transmit multiple measurements in a transmission in random order. When this is the case, these measurements are typically labeled with a measurement identifier in the transmission. The purpose of the multi-channel facility is to key on these identifying labels for input rather than on the line number where it was transmitted. These multi-channel gage files typically must be created for each part file because of the specific nature of the ordered characteristics involved. Multi-channel gage operation typically utilizes a one-line per transmission gage setup with “#” signs in the gage template. The multi-channel facility is then accessed to tie a channel I.D. to an individual part characteristic.

The window for setting up multi-channel translation looks like this:



The image shows a dialog box titled "Multi-channel description". Inside the dialog, there is a label "Channel information1/64". Below this, there are four input fields: "Prompt:" (empty), "Identifier:" (empty), "Reading #" (containing the number "1"), and "Column:" (empty). At the bottom of the dialog, there are four buttons: "<<Previous", "Save", "Cancel", and "Next>>".

Channel Information

The “Channel information” area displays the current channel description number.

Prompt

Use the “Prompt” field to enter a message to be sent to the gage to request a reading from the current channel. This field should not be used to request a reading from all channels. Any global requests should be entered at the main gage setup screen.

Identifier

Enter a set of characters in the “Identifier” field that uniquely identify the line containing the reading for the current channel. This may be a label like: “X axis=” or “radius=” or a channel number such as “01” or “A”. It is important that you enter the characters in the exact column positions that they occur in the gage transmission.

Reading Number

The “Reading number” field allows for multiple readings per line to be handled. If only one measurement is transmitted per line then enter “1” in this field.

Column

The “Column” field does not allow input. It merely displays the cursor’s position for the “identifier” field, so you can locate the specific channel identifier in the exact position of the line’s transmission string. For example, if the gage interface transmits 02 as the channel identifier in position 10 and 11, you must put “0” in position 10 and “2” in position 11 of the “identifier” field. The column field shows you where you are as you move the cursor.

Previous and Next Buttons

The PREVIOUS and NEXT buttons allow you to scan and set up to 64 channel descriptions.

Save Button

The SAVE button saves the template.

Cancel Button

The CANCEL button exits without saving.

Special Menu - Multi-Channel A/D

The "Multi-channel" A/D window is a combination of the two previously described windows. It is used in situations where you need to communicate with an analog to digital interface that has more than one channel.

The screenshot shows a dialog box titled "Multi-channel description". It contains several input fields and buttons. At the top, it says "Channel information 1/64". Below this are fields for "Prompt:", "Identifier:", "Reading #:" (with a value of 1), and "Column:". There is a "Serial port to test:" dropdown menu set to 1 and a "Timeout:" field set to 7. A "Message:" text area is below these. Under the "Analog to Digital" section, there are four input fields: "High Master:", "Low Master:", "High Gage Reading:", and "Low Gage Reading:", all with a value of 0. To the right of these are two buttons: "Master High" and "Master Low". At the bottom of the dialog are four buttons: "<< Previous", "Save", "Cancel", and "Next >>".

Channel Information

The "Channel information" area displays the current channel description number.

Prompt

Use the "Prompt" field to enter a message to be sent to the gage to request a reading from the current channel. This field should not be used to request a reading from all channels. Any global requests should be entered at the main gage setup screen.

Identifier

Enter a set of characters in the "Identifier" field that uniquely identify the line containing the reading for the current channel. This may be a label like: "X axis=" or "radius=" or a channel number such as "01" or "A". It is important that you enter the characters in the exact column positions that they occur in the gage transmission.

Reading Number

The "Reading number" field allows for multiple readings per line to be handled. If only one measurement is transmitted per line then enter "1" in this field.

Column

The "Column" field does not allow input. It merely displays the cursor's position for the "Identifier" field, so you can locate the specific channel identifier in the exact position of the line's transmission string. For example, if the gage interface transmits 02 as the channel identifier in position 10 and 11, you must put "0" in position 10 and "2" in position 11 of the "Identifier" field. The column field shows you where you are as you move the cursor.

Serial Port to Test

The "Serial port to test" area includes a pull down list for specifying which RS-232 port will be used for testing.

Timeout

Use the "Timeout" field to enter the number of seconds the template will wait for an RS-232 string from the instrument.

Message

The "Message" field allows DataLyzer Spectrum Gage Management software to report messages about the transmission being received. Messages such as "reading complete" or "time out error" may display in this field.

Analog to Digital

The "Analog to Digital" area allows you to high and low master the gage and set the software to do an automatic interpolation.

The procedure:

1. Enter the size/measurement of your high master in the high master field.
2. Enter the size/measurement of your low master in the low master field.
3. Position your cursor in the high gage reading field, then put your high master into the gage. Press the MASTER HIGH button. If you are not using a gage prompt, you will need to press the footswitch or send button on the gage. The value will transmit from the gage in terms of a number of digital segments as discussed earlier and will display in the "high gage reading" field.
4. Position your cursor in the low gage reading field, then put your low master into the gage. Press the MASTER LOW button. If you are not using a gage prompt, you will need to press the footswitch or send button on the gage. The value will transmit from the gage in terms of a number of digital segments as discussed earlier and will display in the "low gage reading" field.
5. Save the gage file template by using the SAVE button.

This sets up an automatic interpolation relationship. The software does the following calculation

automatically:

$$[(\text{High master size}) - (\text{Low master size})] / [(\text{High \# segments received}) - (\text{Low \#segment received})]$$

This defines the “measurement size” corresponding to each digital segment received. The multiplication of the number of segments by the measurement increment per segment is then done automatically in the background so the actual measurement value is entered in the input window as the current measurement value.

Previous and Next Buttons

The PREVIOUS and NEXT buttons allow you to scan and set up to 64 channel descriptions.

Save Button

The SAVE button saves the template.

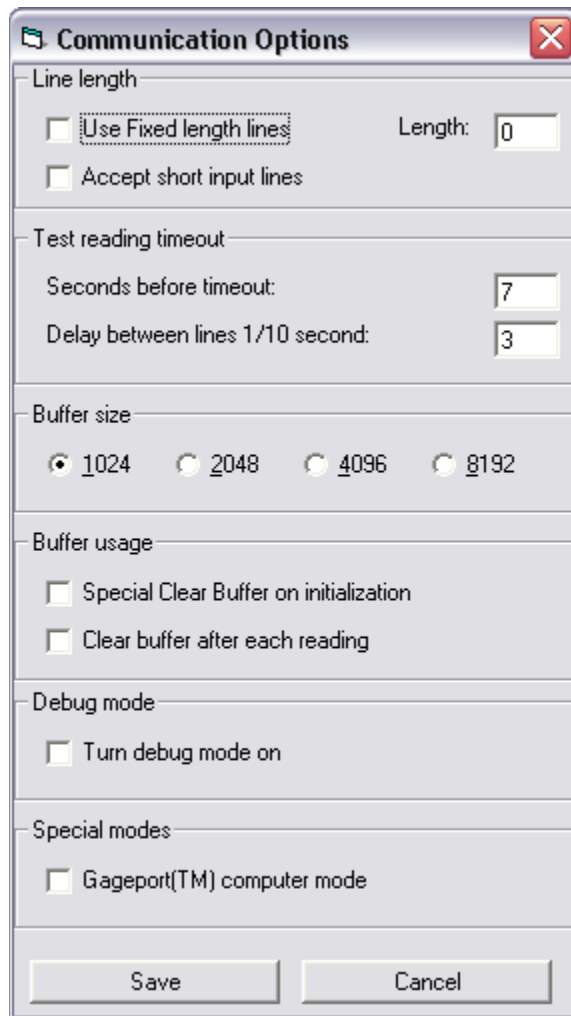
Cancel Button

CANCEL exits without saving.

7.12.4 Options Menu

Communications Options

The “communications options” feature defines the RS-232 communication environment and sets some general rules for communication.



The image shows a Windows-style dialog box titled "Communication Options". It contains several sections with checkboxes and input fields. The "Line length" section has a checkbox for "Use Fixed length lines" (which is highlighted with a dashed border) and a "Length:" input field set to "0". Below it is a checkbox for "Accept short input lines". The "Test reading timeout" section has two input fields: "Seconds before timeout:" set to "7" and "Delay between lines 1/10 second:" set to "3". The "Buffer size" section has four radio buttons: "1024" (selected), "2048", "4096", and "8192". The "Buffer usage" section has two checkboxes: "Special Clear Buffer on initialization" and "Clear buffer after each reading". The "Debug mode" section has a checkbox for "Turn debug mode on". The "Special modes" section has a checkbox for "Gageport(TM) computer mode". At the bottom are "Save" and "Cancel" buttons.

Section	Option	Value / State
Line length	Use Fixed length lines	Length: 0
	Accept short input lines	Unchecked
Test reading timeout	Seconds before timeout:	7
	Delay between lines 1/10 second:	3
Buffer size	1024	Selected
Buffer usage	Special Clear Buffer on initialization	Unchecked
	Clear buffer after each reading	Unchecked
Debug mode	Turn debug mode on	Unchecked
Special modes	Gageport(TM) computer mode	Unchecked

The SAVE button stores the data and sends you back to the gage setup window. The CANCEL button cancels any changes made and sends you back to the gage setup window.

Use fixed length lines / Length

To use the "use fixed length lines" option, mark the check box and set the number of characters allowed in each line to be accepted from the buffer. This option is only used when the strings have no discernible line terminator. This setting supersedes the line terminator designation on the opening gage setup screen.

Accept short input lines

The "accept short lines" option allows the program to attempt to process gage readings even when the defined template extends beyond the end of the string received. If the template has # signs in positions 1 through 8 and the transmission received is only 4 characters long, normally this transmission would be discarded as an error. However, with this button selected, the program will

attempt to evaluate the characters received.

Test Reading Timeout

The “test reading time out” feature allows setting the number of seconds to accept data during use of the communication test window. Seven seconds is the default.

Seconds before timeout

The “Seconds before timeout” option is provided for gages that may take more than seven seconds to run a test, where the gage is across the room, or any scenario where it is difficult to send a sample reading in the default time.

Delay between lines 1/10 second

When a gage sends multiple lines, the program assumes that they will be sent one after another immediately. However, some gages do some calculations between lines or have intermediate steps that cause additional delays. If the program does not receive the complete transmission in a prompt fashion it discards the entire transmission. By setting the delay higher the program will wait the specified time between lines before giving up. Regardless of the delay specified, when the reading is received the program will display it immediately. With a large value in this field, the program will appear to be locked up once a transmission has started until either the transmission is completed or until the specified delay has elapsed. The value entered is in tenths of seconds not seconds. When using BAUD rates below 2400 it may be necessary to specify a small delay of up to 5/10 of a second to account for the slow transfer rate. Another instance where this delay should be increased from the default is when a whole report that is ordinarily printed is being redirected to the com port for data acquisition.

Buffer Size

The “buffer size” option boxes must also be set to control the size of each com port character buffer. Specific options are selectable as character buffer sizes. The default (1024) should be adequate for almost all situations. Use larger buffer options only when pages of ASCII information are being transferred through the com port with each transmission. If the buffer size is not large enough, data will be lost.

Special clear buffer on initialization

If a gage sends initialization information on start-up, it will need to be cleared from the buffer or it will be treated as a reading transmission, and erroneous readings will be displayed on the screen. Select this option to clear this information before starting normal gage entries.

Clear buffer after each reading

This facility was originally developed for Microvu optical comparators. It allows one reading or part of a string to be accepted and processed then the buffer is cleared and another string can be accepted without portions of the previous string remaining in the buffer.

Turn debug mode on

This mode intercepts gage transmissions and reports back the trigger that caused the transmission and the contents of the buffer. (See also RS-232 options window and Appendix K for event codes that may be returned.)

Special Modes

The GagePort(TM) Computer mode check box allows the DataLyzer Spectrum Gage Management software to send special codes to the GagePort to pull data from it on demand. This mode causes a "gage" button to appear on the data entry window. The button will be numbered corresponding to the computer's com port number where it is connected. This GagePort Computer Mode is usually used in combination with the multichannel mode. This allows the gage button to access each channel of the GagePort independently. E.g. for GP channel "A", you set the multi channel prompt to send the GP "A". "A" in this command represents the channel number on the GagePort. Checking the GagePort Computer Mode box causes the program to send the other command required in the GagePort's sequence automatically. You do not need to enter the "As" anywhere.

RS-232 Options



The SAVE button stores the data and sends you back to the gage setup window. The CANCEL button cancels any changes made and sends you back to the gage setup window.

Handshaking

The standard handshaking uses RTS/CTS and DSR/DTR. If the owners manual of your instrument indicates XON/XOFF protocol, that can be used by checking the XON/XOFF box and unchecking the others. Refer to the owner's manual for your gage for the specific communication handshake.

Communication Events

The "Communication Events" are typically related to conditions with cabling.

Reject all hardware triggers (default)

The “Reject all hardware triggers” option away all data in the com buffer if other than trigger 2 com event is received. Trigger 2 com event means the acceptable number of characteristics was received by the com buffer.

Ignore all hardware triggers

The “Ignore all hardware triggers” option leaves data in the com buffer time after time.

Allow all hardware triggers

The “Allow all hardware triggers” option attempts to process data in the com buffer no matter what garbage characters may exist.

Framing Errors

These errors typically arise from software errors like incorrect baud rate or parity.

Reject all framing errors (default)

The “Reject all framing errors” option throws away all data with framing errors.

Ignore all framing errors

The “Ignore all framing errors” option attempts to process data in the com buffer no matter what garbage characters may exist.

Allow all framing errors

The “Allow all framing errors” option attempts to process data in the com buffer no matter what garbage characters may exist.

Hexadecimal

In rare cases, instruments will transmit in Hexadecimal code. This option converts the hexadecimal code into readable ASCII text before displaying the string. This item works like a toggle switch. When it is set, the message “HEX” appears next to the “Reading Description” heading. Select the menu option again and “HEX” disappears.

Clear

The CLEAR item resets all gage template fields to their default settings. This includes fields in the SPECIAL and OPTIONS menus.

7.12.5 Gage Template Example 1: Single Line, Single Measurement

Example string: X= -4.379

This is an example of an ASCII character string that might be transmitted from a gage or gage interface. In this example there are several elements: three spaces are transmitted at the beginning of the string (shown as underlines), “X=”, then a space, a “-” (sign), another space, then the measurement value (4.379). Each space these characters occupy in the line is referred to as a column. (The decimal point is counted as a character.) So, the “X” measurement starts in column “9”

and ends in column "13". The sign is located in column "7". To get the "X" measurement out of this string automatically each time it is transmitted, overwrite the "X" measurement value (4.379) with "#" signs and the sign with an "S". This way each time the transmission is sent by the gage, the software will look through this template to pick up values from these column positions. Note: If the sign is always transmitted right next to the measurement value with no spaces between, you can use a "#" sign to overwrite the sign making it part of the measurement value itself.

The "reading description" area reports column positions where measurement values and signs reside. Zeros will appear in the fields of this area until the template has been established through the testing procedure. As the "#" signs are entered in the template, the software picks up their column positions and fills in the "column" fields automatically.

You must use the TEST, CREATE TEMPLATE area to cause the column fields to be filled in.

7.12.6 Gage Template Example 2: Multi-Line

```
Example reading:  _ _ _X=4.379
                  _ _ _Y=3.465
```

In this example, each time the gage transmits, it sends an ASCII character string with two lines. Elements of the transmission include: three spaces at the beginning of the string (shown as underlines), "X=", then a measurement value. An invisible carriage return/line feed also exists at the end of the first line. The second line includes three spaces, "Y=", and another measurement value. Each space these characters occupy in their respective lines is referred to as a column. (The decimal point is counted as a character.) So, the "X" measurement starts in column "6" and ends in column "10" of line "1", and the "Y" measurement starts in column "6" and ends in column "10" of line "2". To get the "X" measurement out of this string automatically each time it is transmitted, overwrite the "X" measurement value (4.379) with "#" signs. Similarly, the "Y" measurement should be overwritten with "#" signs. This way each time the transmission is sent by the gage, the software will use this template to look in these line and column positions for input values.

When templates of this type are used, the reading number of the transmission must be referenced in the FUNCTION area of each characteristic. Characteristics looking for "X" measurement values should have "R" or "R1" in their function fields. Characteristics looking for "Y" measurement values should have "R2" in their function fields.

If you are only interested in one of these measurement values, the whole string is processed but we overwrite only the measurement value of interest with "#" signs. In this case, no "R" or "R1" references in the characteristic function areas are not necessary.

The "reading description" area reports the line and column positions where measurements reside. Zeros will appear in the fields of this area until the template has been established through the testing procedure.

7.12.7 Gage Template Example 3: Multiple Measurements Per Line

Example reading: X=4.379_Y=3.465

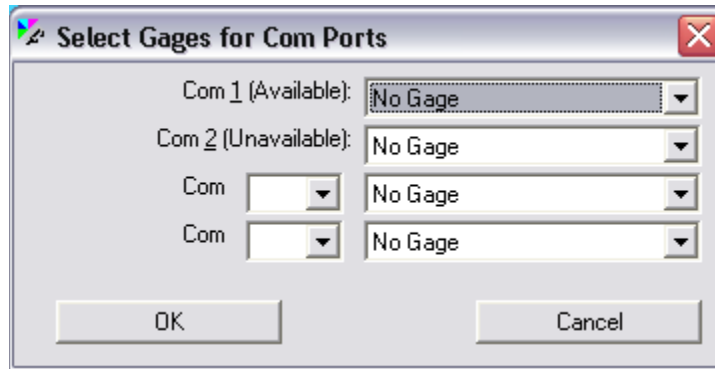
This is an example, each time the gage transmits a one-line ASCII string containing two measurements. Elements of the transmission include: three spaces transmitted at the beginning of the string (shown as underlines), "X=", then a measurement value followed by another space, "Y=", and another measurement value. Each space these characters occupy in the line is referred to as a column. (The decimal point is counted as a character.) So, the "X" measurement starts in column "6" and ends in column "10", and the "Y" measurement starts in column "14" and ends in column "18". To get the "X" measurement out of this string automatically each time it is transmitted, overwrite the "X" measurement value (4.379) with "#" signs. Since the "Y" measurement is in the same line, its measurement should be overwritten with "\$" signs. This way each time the transmission is sent by the gage, the software will use this template to look in these column positions for input values.

When templates of this type are used, the reading number of the transmission must be referenced in the FUNCTION area of each characteristic. Characteristics looking for "X" measurement values should have "R" or "R1" in their function fields. Characteristics looking for "Y" measurement values should have "R2" in their function fields.

The "reading description" area reports column positions where measurements reside. Zeros will appear in the fields of this area until the template has been established through the testing procedure.

7.13 Com Port Assignments

The purpose of the com ports window is to assign existing gage interface template files (gage drivers) to control particular communication ports on the computer. One gage driver can be assigned to each com port. Data can then be sent directly from the gage to DataLyzer Spectrum Gage Management software. Com port assignments can be changed at any time. If no gage is necessary, fields can be left at "No Gage" The DataLyzer Spectrum Gage Management software allows you to communicate directly with a wide variety of RS-232 devices. The COM PORT ASSIGNMENTS and GAGE INTERFACE TEMPLATE menu items work together to define this communication. Each computer com port (1-2 and 2 virtual ports) can be controlled by a driver that defines how that com port will communicate. The COM PORT ASSIGNMENTS menu item displays which drivers are invoked on which com ports. The GAGE INTERFACE TEMPLATE menu item allows definition, editing and testing of the gage drivers themselves.



The DataLyzer Spectrum Gage Management package provides predefined drivers for most popular interfaces and serial gages. You can assign these drivers to each com port field by selecting an available gage driver.

You can assign one gage driver to each com port. The sole purpose of the com ports window is to assign existing gage drivers to control particular communication ports on your computer. If no RS-232 communication will be required, the "no gage" option should be used. "No gage" is the default for all com ports at installation. To activate a com port's drop down menu, use [Alt]+the respective number. For example, [Alt]+[1] activates the com port 1 menu and [Alt]+[2] activates the com port 2 menu.

The program will show which com ports are available or unavailable for communication.

When using external, non-DataLyzer software TSR gage drivers (i.e. TAL/Fowler software wedge, MicroRidge GageWay II and direct USB interfaces), set the com port(s) to "No Gage".

Experience has proven that a high percentage of communication problems result from the use of an incorrect RS-232 cable. We advise you to always buy RS-232 cables directly from the manufacturer of the gage or interface.

Advanced Concept: IRQ

Windows®, by default, reserves two processor interrupts (IRQs): IRQ4 for com 1 and IRQ3 for com 2. With the advent of virtual com-ports, different numbered com-ports become available (usually com5 and above). Separate software must usually be employed to establish the existence of these additional com-ports in the operating system. This allows the simultaneous use of more than two RS-232 ports at a time.

7.14 Select Database

This option is available only for the Microsoft® Access database platform. Use the windows browser to locate and select the location of the desired database and press the "Open" button. You will be prompted to restart the program so the different database can be accessed.

Part



8 Help - (Help Menu)

8.1 Help Documentation

The HELP DOCUMENTATION item accesses the DataLyzer Gage Management help system. Use the search facility to find all references to a topic you enter or move to the beginning of a general topic by selecting it from the list of topics.

Press F1 on the keyboard at any time to show the help screen. If you have a window or dialogue box open specific help for that window will be shown.

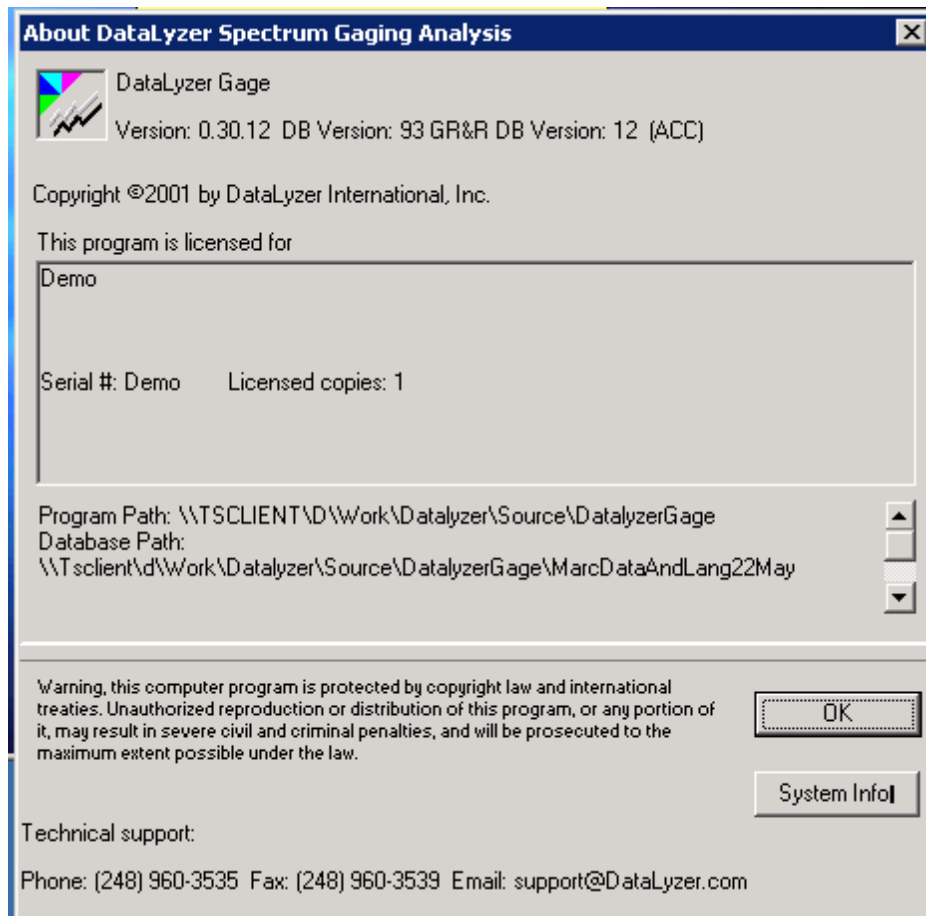
8.2 DataLyzer Application Notes

Selecting this menu item takes you to the DataLyzer International website.

8.3 About GR&R Spectrum

ABOUT GR&R SPECTRUM item provides some general information about the software and installation. Information like version number, database type (ACC=MS Access, SQL=MS Sequel Server and ORCL=Oracle), program path and database path information is also included.

The following window offers an example of what the "About DataLyzer® Spectrum" window looks like.



OK Button

The OK button will close the window.

System Information Button

The SYSTEM INFORMATION button will open the "Microsoft System Information" window for your computer.

Send Error Log Button

The SEND ERROR LOG button will appear on the "About DataLyzer®" window if an error has occurred and an error log was created by the system and exists in the Spectrum program folder. Press this button to send the error log via e-mail to our technical support department. You must have access to the internet to use this feature, but no e-mail privileges are necessary.

Part



IX

9 Appendices

9.1 Appendix A - Computer Requirements

Computer Requirements

Item	Minimum for use with Microsoft® Access™ Database	Minimum for use with Microsoft SQL Server® or Oracle® Databases
CPU	Pentium® 233 MHz	Pentium 3
RAM	128 MB	256 MB+
Graphics	VGA (800x600)	VGA (800x600)
Operating System	Windows® 98	Windows 98
RS-232 or USB ports*	Required for Gage I/F	Required for Gage I/F
CD ROM Drive	Required	Required
Mass Storage	1 GB minimum	1 GB minimum
Uninterruptible power supply (UPS)		

*Comport gage drivers are user-configurable through the software. The operating system allows as many as two comports to be used simultaneously.

9.2 Appendix B - Installation

The DataLyzer Spectrum Gage Management software will operate alone or link to the DataLyzer Spectrum SPC module.

Using the Gage Management System with the DataLyzer Spectrum SPC Package with Microsoft Access, Microsoft SQL Server, and Oracle Databases

If you are using both the DataLyzer Spectrum Gage Management System and the DataLyzer Spectrum SPC packages, you should install the SPC packages first, if they are not already installed; follow the instructions in the DataLyzer Spectrum SPC user's manual. After the DataLyzer Spectrum SPC package(s) has been installed, install the Gage Management System software.

By default both programs are installed in the same folder (C:\Program Files\DataLyzer Spectrum), and will use a single database, in order to allow results to be shared by both programs.

Note: When using a Microsoft Access database, if the SPC and Gage Management programs have not been installed in the same folder or the dsdbase.mdb database file has been installed to a

location other than the default (such as a server), you will need to select the desired database using SETUP, SELECT DATABASE in either package. You can see the path of the database currently being used by the program by going to HELP, ABOUT DATALYZER.

Using the Gage Management System Only

When using a Microsoft Access database, install the Gage Management System software following the “installation instructions” below. The program is then ready to run with no additional steps required.

When using Microsoft SQL Server or Oracle databases, you must first create and set up your ODBC connections. Look in the “SQL Docs” folder under the program folder for installation documents.

CreatingSpectrumDBSQLServer or CreatingSpectrumDBSQLServer2K
SettingUpSpectrumWithSQLServer

CreatingSpectrumDBOraclev8 or CreatingSpectrumDBOraclev9
SettingUpSpectrumWithOracle or 94SettingUpSpectrumWithOracle

Follow the instructions in these documents to create and set up your ODBC connections, then install the Gage Management System software using the instructions below.

Installation Instructions

Insert the DataLyzer Spectrum Gage Management CD into your CD drive. The “Setup” program will run automatically after a few seconds (if not, run the setup.exe program from the CD). The “Setup” program will prompt you through the installation procedure. Almost all users should use the “Typical” option for installation.

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